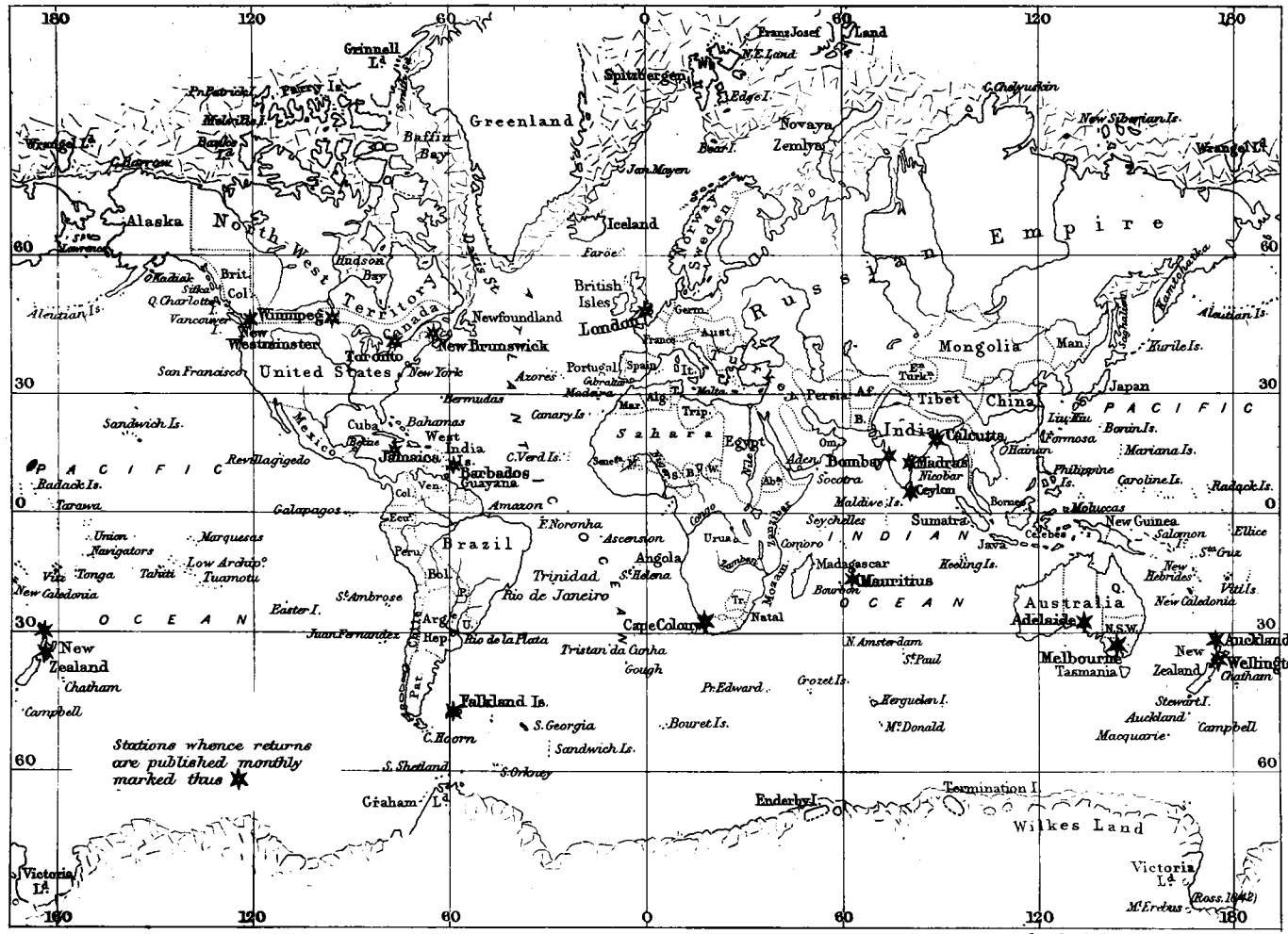

Stanford's Geographical Establishment

SYMONS'S

MONTHLY

METEOROLOGICAL

MAGAZINE.

VOLUME THE EIGHTEENTH.

1883.

LONDON:
EDWARD STANFORD, CHARING CROSS, S.W.
AND ALL BOOKSELLERS.

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SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCV.] FEBRUARY, 1883. [PRICE FOURPENCE, *or 5s. per ann. post free.*

OUR CLIMATOLOGICAL TABLES.

AT the commencement of a new volume, it is well to look back at the previous one, and in so doing it occurred to us that it would be well to bring prominently before our readers the unique features of our Climatological Tables, fourteen of which have now appeared in these pages.

The special features are three—(1) wide distribution; (2) simultaneity; (3) uniformity.

As regards their distribution, we have thought it might be convenient to prepare a map, showing distinctly the sites of the stations, and nothing could give a clearer idea of the distribution than that afforded by the map. We have marked a station in British Columbia, although at present we are not sure of its *precise* locality, inasmuch as we have left the selection of the station to the Director of the Canadian Meteorological system, Mr. Carpmael, of Toronto.

The simultaneity of the returns renders it possible to determine approximately whether hot periods and cold periods prevail over the whole globe or only in small districts, and whether excessive heat or cold in one part is usually compensated by the prevalence of the opposite extreme in another.

As to uniformity, our tables go as near to absolute identity as possible; we give identical data from each station, but obviously the conditions under which those data are observed vary—*e.g.*, Min. on grass at Madras or Bombay must be a difficult observation to make when weeks of scorching sun have withered every blade.

We feel sure that our readers will join us in thanking the distinguished men who furnish the returns, for their continued and indispensable assistance.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	70·6	3	37·8	15	64·7	47·3	48·1	78	125·2	34·7	2·39	9	6·0
Cape of Good Hope	86·8	19	33·8	1	69·6	47·7	50·2	76	...	...	2·13	9	4·2
Mauritius	78·2	24	58·4	30	75·0	66·5	60·4	71	...	...	2·58	17	6·4
Calcutta	92·2	26	74·2	25	87·5	77·2	77·7	87	157·5	71·7	10·50	16	6·6
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	86·8	30	73·7	10	84·0	76.0	75·8	86	148·6	70·1	10·08	17	7·5
Ceylon	87·2	11*	74·8	30	86·1	78·0	72·0	72	151·0	71·0	2·14	11	6·9
Melbourne	78·9	23	34·1	15	63·4	46·3	41·8	64	141·2	28·0	1·19	15	6·3
Adelaide	91·0	23	39·4	9	66·4	48·0	45·3	64	160·5	35·8	·70	15	6·4
Wellington	62·5	24	37·0	16	58·3	47·1	...	...	126·0	33·0	3·00	11	...
Auckland	67·3	30	44·1	24	61·7	49·1	47·0	74	131·2	37·8	2·68	18	7·8
Falkland Isles	50·8	22	30·3	21	43·1	35·5	37·3	91	107·0	24·2	1·70	17	8·4
Jamaica	90·8	30	72·6	25	88·0	74·2	73·4	80	...	67·2	3·68	...	6·5
Barbados	85·0	var.	71·0	5	83·0	74·0	73·1	78	151·0	70·0	7·05	15	5·0
Toronto	88·3	18	43·1	24	69·9	53·1	53·1	70	142·0	36·0	2·09	8	5·1
New Brunswick,S.John	82·0	3	44·0	28	67·1	53·1	52·5	87	...	...	1·89	4	6·6
Cape Breton, Sydney	76·5	1	39·5	14	64·9	50·4	53·2	86	...	...	7·87	12	6·9
Manitoba, Winnipeg	80·7	1	24·6	20	68·5	42·7	48·8	77	134·0	...	·79	5	3·9
British Columbia	...	...	...	...	...	...	...	...	...	...	...	...	...

* And 26.

REMARKS, SEPTEMBER, 1882.

Mauritius.—Rainfall 1·08 in. above the average; mean temp. 0°·5 above it; mean pressure, 30·175 in.; mean hourly velocity of wind 12·4 miles, extremes 31·6 miles and 1·7 miles; prevailing direction E.S.E. to E by S. C. MELDRUM, F.R.S.

Ceylon.—Lightning was seen on six occasions. J. STODDART.

Melbourne.—Mean temp. 1°·1 above the average of 24 years; temp. of dew point 1°·9 below it; mean pressure slightly, and rainfall considerably below the average, prevailing direction of wind N.; strong breezes occurring on eleven days; hot wind on the 23rd, heavy squalls on four days, and strong Northerly gale on 29th, heavy dews on three days, hoar frost on 15th, H on 6th and 17th, TSS on 17th and 29th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure 30·063 in. Mean temp. 57°·2, corresponding exactly with that of the previous 25 years, but the rainfall was remarkably light, and the total since the commencement of the year is 4·48 in. below the mean of 43 years; this scarcity of R has been general throughout the Colony. C. TODD.

Wellington.—Generally stormy weather throughout the month, with prevailing N.W. wind; strong winds on eleven days; total rainfall small, but some heavy showers; T on 25th and 26th, H on 9th, and 23rd. R. B. GORE.

Auckland.—Weather variable, occasionally very fine; very stormy from 22nd to 28th, hailshowers on 24th and 25th, with very strong wind S.W. to W.; TS with heavy R (1·16 in.) on 26th, mist on 6th and 9th. E. B. DICKSON.

BARBADOS.—Mean pressure below the average; mean temp. (74°·7) same as the average; average velocity of wind 7·9 miles per hour, extremes 21·6 miles and 3·5 miles, rainfall 17 per cent. below the average, and evaporation 22 per cent. above it. Five days were overcast; TSS on 5th, 11th, and 23rd. R. BOWIE WALCOTT.

CAPE BRETON.—On 12th 3·45 in. of R fell. C. CARPMAEL.

A PALACE OF ICE.

WHILE the climate of England is oscillating between the close moisture of May, the bitter north-east winds of March, and the sleet and fog of November and December, Canada is rejoicing in the steady cold but bright and dry weather, upon the recurrence of which every one in the Colony reckons, and reckons not in vain. Winter there is a source of great profit and of keen enjoyment. Without the regular frosts and dry snows with which the country is visited, half the work of the farm and of conveying the produce of the forests and the farm to market, would have to be left undone; and while the agriculturist and the lumberer look forward to the advent of a steady "cold spell"—to say nothing of the opportunity that is afforded of laying up a store of ice for summer use—the people generally are not slow to avail themselves of the pleasure of sleighing, skating, and tobogganing. This year the citizens of Montreal have inaugurated a new institution in the shape of a magnificent "Crystal Palace," which has been erected in Dominion Square in that city. Instead of glass and iron, ice is the material of which this building is constructed Slabs of ice from the St. Lawrence, 40 inches high and from 14 to 20 inches in breadth and height, are the "bricks"; and these crystal blocks, piled on one another, are cemented together by a spray of water poured over them, which froze as it fell, and bound the whole together in a homogeneous mass. Of such material has a huge transparent palace been built, measuring nearly 100 feet square in the interior, with walls 25 feet high, and with towers 15 feet square and 30 feet in height; while from the centre rises a massive tower 32 feet square and 100 feet high. The roof is constructed of rafters of wood, upon which were spread cedar branches; these, again, being cemented together, like the walls of the structure, by a spray of water, which froze them into a solid mass, with long icicles depending from the roof in most picturesque confusion. When the bright sun falls upon this glitter ing palace with its frosted roof, the effect is indescribably beautiful; while at night, illuminated with thousands of electric lights within and without, the spectacle is, if possible, of even greater brilliancy.—*The Colonies and India.*

[This is not a new idea. Among the earliest recorded architectural attempts with ice as the material, were those of Lieutenant de Meynerts, at Lubeck, who having carved a lion about 7 feet long, surrounded it by a bastion mounted with five cannons, a soldier, and a sentry box, all formed out of ice. But M. le Chambellan Alexey Danielowitsch Tatischtschew, of St. Petersburgh, at the commencement of 1740, proceded much further, and at the cost of the Empress Anne, constructed an elaborate ice palace consisting of several rooms, even the furniture of which was made of ice. Perhaps the most remarkable fact, was the making and firing of ice cannons. These cannons were modelled from the ordinary service cannons of

which the charge was 3-lbs. of gunpowder—these ice ones were loaded with ¼-lb., and a bullet thrown by one of them pierced a plank 2 inches thick at a distance of 50 paces—as this appears a rather wonderful story, we finish this note by quoting Krafft's* arguments upon the subject:—

"Nous aprenons encore, qu'il est possible de tourner la glace au tour, de la percer, de la tailler, de la peindre ou enduire avec des couleurs, de la mettre en feu aprés l'avoir frotée de naphte, et enfin de s'en servir à tirer, sans qu'il soit besoin comme quelques uns l'avoient présumé, de garnir de tole le dedans du Canon. L'entreprise et l'execution d'un dessein si rare, nous a convaincu de la vérité de toutes ces choses, dont la plû-part ont pourtant été traitées de fictions par quelques personnes en Allemagne. Mais cette incredulité n'a rien qui nous surprenne. Je dirai plus, c'est que je suis assuré que plus avant la renommée de notre édifice de glace se répandra dans les païs Méridionaux, et plus la vérité en paroitra incroïable. On ne peut nier que la poudre à Canon n'ait une vertu fracassante, si j'ose me servir de ce terme; c'est par cette raison qu'il a semblé incroïable à quelques personnes, qu'on ait pû tirer avec nos Canons de glace, sans qu'ils se soient brisés en mille piéces. Mais je prie les incrédules de considérer, que cette vertu qu'a la poudre de fracasser, ne peut opérer que là où elle trouve le moins de résistence. Or si la glace dont est fait la Canon, est assés solide pour faire plus de résistence à la poudre, que n'en font le boulet qu'on a fait couler dans l'ame de la piéce, et le bouchon dont on ne peut se passer en la chargeant; qui ne voit que la vertu de la poudre opére necessairement sur ces derniers, qui sont les parties qui lui résistent le moins, qu'elle s'y fait jour, et laisse la glace en son entier?

* * * * * * *

"Je ne m' arrêterai pas davantage à rêpondre aux objections qui nous ont été faites. Il me sufit que plusieurs miliers de personnes ont été témoins oculaires durant un long tems de la vérité de tout ce que j'ai raporté jusqu'ici de cette maison de glace."]

THE METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, the 17th ult, at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair.

The Secretary read the Report of the Council, which showed that the total number of Fellows was 571; 47 new Fellows having been elected during the year.

The President then delivered his address. He referred briefly to the great importance of the uniform series of observations now taken under the auspices of the Society, and proceeded to speak at greater length of certain other points in which the society might, by its concerted action, further the interests of meteorological science. The first of these was anemometry, which is at present in a condition far from satisfactory. We know nothing positively either as to the pressure

* Description et Représentation exacte de la Maison de Glace construite a St. Petersbourg, au Mois de Janvier, 1740, par. Prof. G. W. Krafft, 4to. St. Petersbourg, 1741.

or the velocity of the wind; there is no exact standard instrument; and observations, whatever may be their absolute value, are not comparable one with the other. He thought that the Society might properly interfere, so far as to regulate the wide diversity amongst the instruments now used, in order that when the proper time came, and it was known what anemometer could be trusted, the older observations might be reduced. The movement of air in the upper regions of the atmosphere is not measurable by any existing method, but experiments have been made, at the suggestion of the Meteorological Council, in which the drift of the smoke-cloud of a bursting shell may be observed and measured. The observations of the barometer taken at elevated stations in the United States seem to throw considerable doubt on the received formulæ for the reduction of barometric readings to sea-level, and for the calculation of heights. When the observations extend over a long period, and are regularly taken under all conditions of weather, then no doubt the height of a mountain can be calculated with a fair approach to accuracy; but isolated observations, subject to the fluctuations of the different readings are extremely wild in their results. In the same way, the reduction of the barometer to sea-level is complicated by many discrepancies which arise between observations at the upper and lower stations, which have hitherto been ignored. It is impossible to say how far they affect the isobars on which our daily weather charts are based; but it seems probable that they are at least one additional source of error and of difficulty. It is much to be wished that systematic and continuous observations at high-level stations could be taken, not only on the top of Ben Nevis, but on the top of some others of the highest peaks in different parts of the country. In this way alone, can these difficulties of reduction be cleared away.

The following gentlemen were elected the Officers and Council for the ensuing year:—

President.—John Knox Laughton, M.A., F.R.A.S., F.R.G.S.

Vice-Presidents.—Edmund Douglas Archibald, M.A.; Rogers Field, B.A., M.Inst.C.E.; Baldwin Latham, M.Inst.C.E., F.G.S.; William Marcet, M.D. F.R.S., F.C.S.

Treasurer.—Henry Perigal, F.R.A.S.

Trustees.—Hon. Francis Albert Rollo Russell, M.A.; Stephen William Silver, F.R.G.S.

Secretaries.—George James Symons, F.R.S.; John William Tripe, M.D., M.R.C.P.Ed.

Foreign Secretary.—Robert Henry Scott, M.A., F.R.S., F.G.S.

Council.—Hon. Ralph Abercromby; William Morris Beaufort, F.R.A.S.; F.R.G.S.; John Sanford Dyason, F.R.G.S.; Henry Storks Eaton, M.A.; William Ellis, F.R.A.S.; Joseph Henry Gilbert, Ph.D., F.R.S., F.C.S.; Charles Harding; Robert John Lecky, F.R.A.S.; Capt. John Pearse Maclear, R.N.; Edward Mawley, F.R.H.S.; George Mathews Whipple, B.Sc., F.R.A.S.; and Charles Theodore Williams, M.A., M.D., F.R.C.P.

THE RECENT FLOODS IN WESTERN EUROPE.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the article in the January number of the *Meteorological Magazine*, I send herewith some data respecting rainfall :—

RAINFALL DEC. 24–JAN. 4.

	Salzburg.	St. Georgen near Salzburg	Ischl.	Schafberg.	Linz.	Krems.	Wien.
Altitude in feet :	1431	1847	1532	5827	886	752	666
DATE.	in.	in.	in.	in.	in.	in.	in.
December 24	·51 s	...	·91 s	2·01 s	...	·04 s	·04 s
,, 25	·47 sr	...	1·06 r	·59 s	·04 s	·04 s	...
,, 26	1·24 r	2·24 rs	2·84 r	3·11 sr	·35 s	·08 s	·39 rs
,, 27	·67 r	2·21 r	2·56 r	2·79 sr	·47 r	·12 r	·79 rs
,, 28	·06 r	1·50 r	·35 r	2·09 r	1·54 r	·83 r	·08 r
,, 29	...	·04	...	·08 r	·35 r	...	...
,, 30	·06 r	...	·16	...	...	...	...
,, 31	·61 r	·63 r	1·02 l, r	·63 s	·47 r	·04 r	·20 s
January 1	1·69 r	?	2·64 r	?	91 r	?	·59 r
,, 2	·15 r	·16 r	·51 r	?	·35 r	?	·39 r
,, 3	·33 r	·32 r	·51 r	?	?	?	·20 r
,, 4	·04 sr	·04 r	·04 r	?	?	?	·08 r
Totals	5·83	7·14 ?	12·60	11·30 ?	4·48 ?	1·15 ?	2·76

r = rain ; s = snow ; l = lightning.

The flooding was due to the melting of snow by the warm weather, as well as to abundant rainfall.

Raab lies on a branch of the Danube, and was flooded by it, and not by the little river of that name.—Yours truly,

J. HANN.

K.K. Central-Anstalt für Meteorologie und Erdmagnetismus, Hohe Warte bei Wien, Jan. 24.

To the Editor of the Meteorological Magazine.

SIR,—Allow me to send you some notices of facts, which plainly confirm your suggestions on the probable causes of the recent great floods (*Met. Mag.*, Jan. 1883, p. 182-3).

From December 4th to 26th there fell some snow every day in the Alps, the whole amount of which reached on the St. Gotthard 5·20^{m} (17 ft.),or about 520^{mm} (20·47 in.) if melted—the thermometer never rising to freezing point. On December 25th large quantities of fresh snow came down ; 61^{cm} (2 ft.) at Davos; 90 ^{cm} (3 ft.) on the Gotthard. The next day's heavy south-westerly winds everywhere produced a considerable increase of temperature, as the following figures will show :—

Meteorological Station.	Altitude above Sea. Metres.	Feet.	Temperature Fhrt. at 1 p.m. Dec. 25.	Dec. 26.	Dec. 27.
Säntis	2440	8005	8·6	24·8	26·6
Gotthard	2100	6890	12·2	32·0	33·8
Davos	1560	5118	23·0	35·6	35·6
Trogen (Appenzell).	892	2927	32·0	44·6	46·4
Basle	278	912	33·8	50·0	55·4

Snow and rain still continued in the Alps.

At Basle, the Rhine rose from $2^{m}\cdot90$ (9 ft. 6 in.) on the 26th, at 4 p.m. to $4^{m}\cdot82$ (15 ft. 10 in.) on the 27th at 3 p.m., and reached its highest level $5^{m}\cdot62$ (18 ft. 5 in.) on the 28th at 10 a.m., inundating its shore. The quantity of water passing each second under the bridge was at least 4,500 tons, *i.e.*, four or five times as much as usual. The velocity I measured was nearly 3^{m} (10 ft.) per second. (Nearly 7 miles an hour).

The same cause, rapid melting of snow, swelled to a dreadful height, all the rivers running down from the Jura and Black Forest.

Similar circumstances are met with in the Bavarian Alps and the mountain ranges of Germany, the Rhön, Spessart, and others. But while in Switzerland, heavy rains were confined to the highlands; in Germany, the lower countries also received a large amount of water, somewhat exceeding double the normal quantity. The report of the Central Office at Munich contains the following instances with more than 100^{mm} rainfall.

Station.	Total Rainfall during Dec. 1882. mm.	in.
Aschaffenburg	117·9	4·64
Kissingen	104·3	4·10
Passau	143·5	5·65
Nürnberg	165·7	6·53
Cham	119·8	4·72
Weiden	114·0	4·49
Ansbach	111·3	4·38
Augsburg	136·2	5·36
Traunstein	133·5	5·25
Kempten	194·9	7·67
Berchtesgaden	180·6	7·12
Rabenstein	261·0	10·28
Bad Kreuth	317·6	12·52

Hence it was the interference of heavy rains and melting snow which produced the immense floods in the lower valley of the Rhine, while in Switzerland the floods only arising from suddenly-melting snow were not so excessive, and had soon passed.—I have the honor, &c.,

DR. A. RIGGENTACH,

Assistant for Meteorology and Astronomy at the Bernoullianum at Basle.

Basle, Feb. 10th, 1883.

SOLAR HALOS.

[As the writer of the following note lives some thousands of miles away, we have not had time to obtain his permission to print the following portion of a private letter, but it appears to us undesirable that such an interesting statement should be buried, on account of a question of mere etiquette.]—Ed.

I was very much surprised at the statement of the average number of solar and lunar halos in the paper by Mr. Backhouse, *Met. Mag.*, Dec., 1882. With us the lunar is far more common than the solar halo, and neither is so frequent as with you. As a matter of curiosity, I have just looked over my records, and find that in the last three years I have noted six solar and twenty-six lunar halos. In nine years there have been fourteen solar halos. It is a somewhat singular fact, in the summer months none occurred of either kind.

I suppose the difference between the two countries in the frequency of this phenomenon is caused by the greater humidity of the English climate; we have more sunshine and a drier atmosphere.—Yours truly, HENRY D. A. WARD.

Middletown, Connecticut, U.S.A.

SUN SPOT PERIODICITY.

To the Editor of the Meteorological Magazine.

Sir,—In answer to the question on sun spot periodicity (*Met. Mag.*, Jan., 1883, p. 192) allow me to add—

(1). That the researches of Prof. Wolf are published in the last number of his journal "*Astronomisch Mittheilungen*," No. 57, p. 228, 1882, and will also be found, I suppose, in the *Vierteljahrschrift der naturforschenden Gesellschaft zu Zurich.*

(2). One of the periods is entirely new (that of ten years), while the other, of eleven years four months, closely agrees with the previous one of eleven and one-ninth years.

(3). The numbers given by Prof. Wolf may not be altered by more than a month.

(4). The general principle of the investigation may be shortly explained as follows:—Suppose the whole series of 1,440 monthly relative numbers (Relativzahlen) of sun spots to be graphically represented, time as abscissæ, relative numbers as ordinates, the result will be a kind of wave line, part being above, and part below, the straight line (the axis), representing the mean value of sun spot frequency, viz., 47·8. Then cut the whole wave-line into pieces, each embracing exactly ten years for instance; superpose all these pieces, so that the axes of all coincide, and draw the resulting wave-line by adding all overlaying ordinates. Now, if the ten years don't correspond with a period of sun spots, the overlaying ordinates will be partly positive, partly negative, and will, therefore, destroy themselves more or less in the resulting curve. If, on the contrary, the ten years represents a real period, the resulting curve will in the

mean, on both sides, be more distant from the axis than any other curve resulting from pieces embracing nine years eight months, ten years two months, or others. Prof. Wolf has tried all periods, from nine years six months, nine years eight months, and so on, to twelve years six months. The curves for ten years and for eleven years four months showing a clearly-pronounced maximum of mean ordinates, correspond, of course, with real periods of sun spots.—I have the honour to be, Sir, your obedient servant,

DR. A. RIGGENTACH,
Assistant for Meteorology and Astronomy at the Bernoullianum at Basle.

Basle, Feb. 10, 1883.

RAINFALL AT KIMBERLEY, SOUTH AFRICA.

GAUGE 5IN., BY NEGRETTI & ZAMBRA.

MONTH.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	7·11	2·57	1·50	·66	·50	2·44	5·32	5·95	1·60
February	8·98	3·62	4·00	3·88	2·93	2·78	1·34	6·05	1·30
March	3·00	2·25	2·25	1·41	·81	4·45	·60	8·10	3·80
April.....	·53	·86	?	·05	·41	·23	·30	1·40	1·08
May	?	1·75	?	·93	·71	·53	·23	1·73	1·27
June	?	·22	Snow	·00	·00	1·29	·02	·13	·03
July	S ·91	S 1·30	?	·66	·63	·61	·00	·00	·81
August	?	·05	?	·35	1·10	·30	·00	S ·84	·75
September ...	?	·00	?	·87	·00	5·95	·00	·00	1·26
October.....	?	1·13	?	1·24	·16	·00	2·10	·43	·47
November ...	?	1·64	?	1·35	1·15	·27	1·50	5·03	·80
December.....	?	1·87	?	2·18	·94	·53	4·02	·64	1·60
Total.....	?	17·26	?	13·58	9·34	19·38	15·43	30·30	14·77

NOTE.—Snow fell July, 1874–75, June, 1876, August, 1881.

HEAVIEST RAINFALLS.

Feb. 27th, 1879, 2·20 fell in less than two hours.
Sept. 22nd, 1879, 1·63 fell in about three hours.
Night, Sept. 27th, 1879, 2·14 fell in about five hours.
December 10th, 1880, 1·00 fell in two hours.
Jan. 27th, 1881, 2·17 fell in about two hours.
Feb. 2nd, 1881, 1·30 fell in one hour.
Feb. 6th, 1881, 0·82 fell in half-an-hour.
Feb. 25th to 27th, 1881, 3·32 fell in three days.
Night of March 3rd, 1881, 1·44 fell in ten hours.
March 9th to 12th, 1881, 4·98 fell in four days.
Nov. 2nd, 1881, 2·80 fell in about three hours and a half; the bulk fell in about one hour.
Night of March 12th, 1882, 1·90 fell in eight hours.

F. W. MATTHEWS.

Kimberley, January 12, 1883.

THE RECENT MILD WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—With reference to Mr. Gwilliam's letter in the *Meteorological Magazine* for January, on the recent mild weather, I enclose my observations for the same week (that ending January 1st, 1883). My thermometers are verified, and are in a Stevenson's screen.

DATE.	Bar.	Max.	Min.	Mean.	Min. on grass.	Rainfall.
Dec. 26th, 1882..	29·42	51°	37°	44°·0	36°	·22
,, 27th	29·45	55°	49°	52°·0	45°	·23
,, 28th	29·48	55°	49°	52°·0	47°	·01
,, 29th	29·50	54°	40°	47°·0	35°	—
,, 30th	29·70	44°	38°	41°·0	38°	·52
,, 31st	29·90	54°	42°	48°·0	42°	·27
Jan. 1st, 1883...	29·70	55°	44°	49°·5	41°	·08
Mean	29·59	52°·6	42°·7	47°·6	40°·6	Total 1·33

Wind :—Dec. 26th, N.W.; 27th, W.; 28th, W.; 29th, W.; 30th, W.; 31st, S.E.; Jan. 1st, S.W.—Yours faithfully,

FRED. COVENTRY.

Ketton Hall, Stamford, January 18, 1883.

[The mean temperature during the above week was, therefore, only 47½ degrees at Ketton (Rutlandshire), against 52 degrees at Bayswater and Greenwich.—ED.]

EXTRACT FROM LOG OF VOYAGE TO WEST INDIES FROM ENGLAND.

Days.	Lat.	Long.	Rain. inches.	Winds.	Evaporation. inches.	Locality.
	° ′	° ′				
Oct. 28...	25 53	39 14	·016	E.N.E.	·262	Atlantic.
,, 29...	23 53	42 37	...	E.N.E.	·308	do.
,, 30...	22 4	46 4	·060	E.	·275	do.
,, 31...	20 7	49 10	...	E.S.E.	·280	do.
Nov. 1...	18 19	52 20	...	E.S.E.	·300	do.
,, 2...	16 12	55 24	...	E.S.E.	·275	do.
,, 3...	13 55	57 45	·012	S.E.	·263	do.
,, 4...	13 4	59 37	...	S.E.	·284	Barbadoes.
,, 5...	14 0	61 0	·020	S.E.	·262	St. Lucia.
,, 6...	14 0	61 0	·058	E.S.E.	·234	do.
,, 7...	14 0	61 0	·010	E.S.E.	·250	do.
,, 8...	13 13	61 13	·115	E.	·288	St. Vincent.
,, 9...	12 3	61 43	·436	E.	·105	Grenada.
,, 10...	10 39	61 23	·500	S. N.E.	·096	Trinidad.
,, 11...	10 39	61 23	...	S.E. N.E.	·158	do.
12..	10 40	63 15	·545	S.E. N.E.	·136	Margarita.
,, 13...	10 55	65 9	...	E.	·128	Tortuga.
,, 14...	10 37	66 56	·236	E.	·127	Caracas.
Total 19..			2·008		4·031	

Mean Rain per diem, 0·111 inches; Evaporation per diem, 0·223 inches; miles steamed per diem, 134.

The above extract from the log of a steamer trading to the Leeward Islands, West Indies, is forwarded for inspection, and may prove interesting to your readers, from containing a *comparison* between evaporation and rainfall at sea.

It may be pointed out that the total amount of *evaporation* was double that of the rainfall, as well as the average per diem, and that the evaporation in the *Atlantic Ocean* was double that in the Carribean Seas, which also will apply to the Windward and Leeward Islands affected. The course through the Atlantic was through the dry *Intra-tropical Belt*, which exhibited little rain, but considerably more fell in the Carribean Seas; after entering the *Equatorial Rain Belt*, under 12° N. Lat., it will be seen that as soon as the *heavy rain* began the amount of evaporation dropped off to nearly half. The *winds* were easterly throughout, in both seas, and were probably the usual winter-trade winds, which are dry and fresh.

The amounts of daily evaporation on board ship certainly appear *rather large*, and would require more observations to substantiate such results, but it should be kept in mind that the ship is constantly moving, and the winds constantly blowing day and night at sea, and that trade winds are drying winds and the sunshine is clear within the tropic lines.

W. J. BLACK, F.M.S.S.

2, George Square, Edinburgh.

[Would Surgeon-Major Black send a brief description of the apparatus employed?—ED.]

SOME WEATHER PROGNOSTICS.

To the Editor of the Meteorological Magazine.

SIR,—There are three sets of popular prognostics, which I find are applied by different people in very different ways, so that I venture to ask whether some of your readers may be able to throw some light on the question.

In the first place, we are familiar with the names of "goat's hair," and of "mare's tails," as applied to clouds. Now, are these identical, or, if not, what is the distinction between them?

In the second place, there is a kind of cloud called in different parts of the country "the hake-shaped cloud," "a salmon," or a "Noah's ark," which is supposed to indicate rain when it stretches east and west, but fine weather when it points north and south. How would you describe this cloud?

Lastly, there are what are called good and bad hours for clearing, that is to say, that if during a rainy day the sky breaks about 11 a.m. or 2 p.m., the improvement will not last, so that these are bad hours. If, on the contrary, the break occurs about noon, or 4 p.m., it is expected that the weather will clear permanently, and these are called good hours of clearing. These are the hours which

hold good in Scotland, but perhaps they vary in different parts of the country.

Allied to this, is the well-known saying—"Rain at seven, fair at eleven; rain at eight, fair late." Can any of your readers give me any information about the rain at seven, which would be specially valuable if they could give the dates on which they have observed the prognostic to hold good.

On all these sayings I would gladly receive information, either through your columns or otherwise. In the case of clouds, the roughest sketch would be more valuable than pages of written matter.—I am, &c., &c.,

RALPH ABERCROMBY.

21, Chapel Street, Belgrave Square, London, S. W.
Feb. 7, 1883.

A LOFTY OBSERVATORY.

REFERRING to the Weather Observatory established at the Government chinchona plantations, Jamaica, the *Jamaica Gleaner* says that the necessary arrangements have been made by Mr. Maxwell Hall. The Observatory is at the residence of Mr. Morris, Director of the Botanical Department, who has undertaken voluntarily to give it personal and daily attention, in addition to the discharge of his regular heavy official work. It is beyond question the highest Observatory in the British Empire, the elevation being 4,900 feet. The mean annual rainfall at this particular spot and elevation is put down at 136 in., and the mean annual temperature at 60° Fahrenheit. The instruments placed at this new observatory, whose readings will have a special importance, are a very fine standard barometer and two good ordinary thermometers, all carefully corrected, and working in harmony with the instruments in Kingston. Apart from the bearing which the readings will have upon questions connected with the selection of land for chinchona, much information of scientific and general interest will be gained from them. Mr. Morris's observations will appear in Mr. Hall's monthly meteorological report in the *Jamaica Gazette.*

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	2·44	XI.	Llanfrechfa Grange	6·78
,,	Margate, Birchington...	1·49	,,	Llandovery	5·98
,,	Littlehampton	2·78	,,	Solva	2·78
,,	St. Leonards	2·27	,,	Castle Malgwyn	7·12
,,	Hailsham	2·99	,,	Rhayader, Nantgwillt..	9·41
,,	I. of W., St. Lawrence.	2·47	,,	Carno, Tybritle	7·51
,,	Alton, Ashdell.....	3·76	,,	Corwen, Rhug	5·41
III.	Great Missenden.....	2·89	,,	Port Madoc	5·28
,,	Winslow, Addington ...	2·68	,,	I. of Man, Douglas	5·05
,,	Oxford, Magdalen Col...	2·29	XII.	Carsphairn	12·03
,,	Northampton	2·75	,,	Melrose, Abbey Gate...	3·37
,,	Cambridge, Beech Ho...	1·29	XIII.	N. Esk Res. [Penicuick]	3·45
IV.	Southend	1·11	XIV.	Ayr, Cassillis House ..	4·01
,,	Harlow, Sheering	1·57	,,	Glasgow, Queen's Park.	6·18
,,	Diss	1·65	XV.	Islay, Gruinart School..	5.17
,,	Swaffham	2·10	XVI.	St.Andrews,NewtonBk	3·92
,,	Hindringham	2·44	,,	Aberfeldy H.R.S.	6·68
V.	Salisbury, Alderbury...	2·62	,,	Dalnaspidal	7·97
,,	Warminster	3·17	XVII.	Keith H.R.S.	·58?
,,	Calne, Compton Bassett	3·03	XVIII.	Forres H.R.S.	1·26
,,	Beaminster Vicarage ...	5·13	,,	Strome Ferry H.R.S....	6·47
,,	Ashburton, Holne Vic..	9·78	,,	Lochbroom	4·67
,,	Torrington,LangtreeW.	4·55	,,	Tain, Springfield.....	1·70
,,	Lynmouth, Glenthorne.	6·02	,,	Loch Shiel, Glenaladale	10·65
,,	Probus Lamellyn.....	4·36	XIX.	Lairg H.R.S.	3·05
,,	Taunton, Fullands	2·91	,,	Forsinard H.R.S.	2·25
VI.	Bristol, Clifton	3·91	,,	Watten H.R.S.	2·18
,,	Ross	4·25	XX.	Fermoy, Glenville	8·19
,,	Wem, Sansaw Hall.....	3·36	,,	Tralee, Castlemorris ...	7·29
,,	Cheadle, The Heath Ho.	3·68	,,	Tipperary, Henry Sreet	5·68
,,	Worcester, Diglis Lock	3·27	,,	Newcastle West	6·50
,,	Coventry, Coundon	3·89	,,	Kilrush	...
VII.	Melton, Coston	2·31	,,	Corofin	8·08
,,	Ketton Hall [Stamford]	2·14	XXI.	Carlow, Browne's Hill..	5·06
,,	Horncastle, Bucknall ...	2·46	,,	Navan, Balrath	3·46
,,	Mansfield Market Place.	3·41	,,	Athlone, Twyford	5·95
VIII.	Macclesfield, The Park.	3·46	XXII.	Mullingar, Belvedere ...	4·88
,,	Walton-on-the-Hill.....	3·77	,,	Clifden, Kylemore	8·47
,,	Lancaster South Road..	6·05	,,	Crossmolina, Enniscoe..	7·71
,,	Broughton-in-Furness ..	8·61	XXIII.	Carrick-on-Shannon ...	7·90
IX.	Wakefield, Stanley Vic.	2·67	,,	Dowra	7·47
,,	Ripon, Mickley	4·94	,,	Rockcorry.....	5·26
,,	Scarborough.....	1·47	,,	Warrenpoint	6·32
,,	EastLayton[Darlington]	3·58	,,	Newtownards	3·07
,,	Middleton, Mickleton ..	8·43	,,	Belfast, New Barnsley .	4·32
X.	Haltwhistle, Unthank..	3·94	,,	Bushmills	3·95
,,	Shap, Copy Hill	13·09	,,	Buncrana	5·0

JANUARY, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·07	— ·28	·34	29	21	55·3	1	28·8	24	4	15
II.		Maidstone (Hunton Court)...	1·52	— 1·05	·25	29	18	...	...	...	...	...	...
,,		Strathfield Turgiss	2·18	— ·37	·45	29	23	54·3	1	25·8	31	6	20
III.		Hitchin	1·91	— ·31	·28	15	20	52·0	1	25·0	23*e*	14	...
,,		Banbury	2·54	+ ·16	·42	29	21	54·0	1	25·5	31	12	...
IV.		Bury St. Edmunds (Culford)	2·00	+ ·16	·53	24	20	55·0	29	25·0	20*e*	17	...
,,		Norwich (Cossey)	1·88	+ ·18	·35	24	16	55·5	1	26·0	21	11	18
V.		Bridport	3·57	...	·50	25	19	...	..	...	...	...	...
,,		Barnstaple.....	3·60	— ·66	·47	14	18	57·0	2	31·0	7	...	...
,,		Bodmin	5·27	— 1·24	·80	10	25	56·0	17	32·0	16	2	6
VI.		Cirencester	3·79	+ ·41	·43	24	24	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	3·79	+ ·36	·52	24	21	53·0	1	26·0	7, 8	11	12
,,		Tenbury (Orleton)	3·99	+ 1·00	·60	24	24	55·7	1	26·3	31	7	14
VII.		Leicester	2·26	...	·32	29	22	54·0	18	28·0	21	6	16
,,		Boston	2·04	+ ·32	·38	24	16	54·0	29	28·0	24	5	...
,,		Grimsby (Killingholme).....	2·32	+ ·56	·52	24	23	53·5	29	26·0	25	5	...
,,		Hesley Hall [Tickhill].....	2·86	...	·40	28	16	54·0	28	25·0	28	11	...
VIII.		Manchester (Ardwick).....	4·15	+ ·91	·92	29	17	53·0	1	28·0	8	6	...
IX.		Wetherby (Ribston Hall) ...	3·21	+ ·99	·46	15*a*	15	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·46	+ 2·53	2·11	28	21	51·0	1	19·0	30	10	...
X.		North Shields	1·53	— ·31	·36	25	17	54·0	1	25·5	31	12	14
,,		Borrowdale (Seathwaite).....	21·92	+ 3·17	3·13	24	25	51·5	1	23·0	9	6	...
XI.	WALES.	Cardiff (Ely).....	5·64	+ ·93	·99	24	22	...	...	...	...	...	...
,,		Haverfordwest	5·59	— ·68	1·00	24	16	54·0	10*c*	28·0	15	7	18
,,		Plinlimmon (Cwmsymlog) ...	5·01	...	·85	28	17	...	...	...	...	...	...
,,		Llandudno.....	2·53	— ·43	·51	28	18	54·0	1, 17	30·2	8	4	...
XII.	SCOTLAND.	Cargen [Dumfries]	7·54	+ 1·43	1·41	24	22	52·0	29	25·6	31	6	...
,,		Hawick	3·02	— ·20	·47	27	16	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	5·72	+ ·28	·95	28	17	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	7·92	+ ·05	2·01	23	23	...	...	26·0	31	11	...
,,		Appin (Airds)	6·30	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	6·50	...	1·43	23	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·20	+ ·38	·70	29	18	...	...	...	...	...	...
,,		Arbroath	2·67	+ ·22	·65	14	14	47·0	1*d*	27·0	31	13	...
XVII.		Braemar	4·75	+ 1·97	1·10	24	19	47·0	17	11·0	31	18	21
,,		Aberdeen	2·82	...	·56	24	16	50·0	1	26·0	7	13	...
XVIII.		Skye (Sligachan)	16·02	...	4·05	17	19	...	...	...	...	...	...
,,		Culloden	1·66	— ·11	...	...	...	49·5	17	25·8	31	12	22
XIX.		Dunrobin	2·07	...	·45	28	11	...	...	...	...	...	...
,,		Orkney (Sandwick)	3·09	— ·25	·54	28	20	48·1	17	30·8	4	1	11
XX.	IRELAND.	Cork (Blackrock)	9·72	+ 3·70	1·90	28	26	53·0	18	25·0	31	11	...
,,		Dromore Castle	7·94	...	·81	26	27	54·0	1	28 0	30	3	...
,,		Waterford (Brook Lodge) ...	5·90	...	·72	26	23	53·0	1	29·0	31	3	...
,,		Killaloe	8·40	...	1·04	28	23	55·0	1	26·0	31	10	...
XXI.		Portarlington	3·97	+ ·91	·63	28	26	55·5	25	26·0	9	9	...
,,		Dublin (Monkstown)	2·68	+ ·42	·68	24	20	55·7	1	30·4	7	2	5
XXII.		Ballinasloe	5·88	...	·66	17*b*	28	52·0	1	26·0	31	12	...
XIII.		Waringstown	3·84	+ ·43	·72	25	18	54·0	1	23·0	31	14	...
,,		Londonderry (Creggan Res.).	4 79	...	·76	23	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·13	+ ·36	·94	23	23	53·0	1	28·0	18*f*	14	...

+ Shows that the fall was above the average ; — that it was below it.

a And 28. *b* And 26. *c* And 12, 13, 14. *d* And 17, 19. *e* And 30. *f* And 25, 30.

METEOROLOGICAL NOTES ON JANUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The land is yet unworked, wet and foul, and but little winter corn has been sown. The new year begins with disease among the flocks and herds; fluke in sheep is general, and swine fever prevails.

BANBURY.—A damp and cheerless month; latter part very stormy; mean temp. (40°·6) about 5° above the average; high wind on ten days. S on 24th and 26th; H on 30th.

CULFORD.—The weather throughout the month was very unsettled, and high winds very prevalent. The sudden changes of temp. have been very trying, causing much sickness.

BODMIN.—A singularly mild January; mean temp. 42°·5.

CIRENCESTER.—A mild and damp month.

WOOLSTASTON.—Latter part of the month very stormy, especially between the 23rd and 28th. Mean temp. 38°·3; S on 25th, 26th, and 29th.

TENBURY, ORLETON.—A very cloudy and damp month, with frequent fogs, and a rainfall much above the average; temp. very near the average of 20 years, but fluctuating; bar. very unsteady, and a rapid succession of strong gales of wind. Ground covered with S on 27th and 30th. The rivers Severn and Teme were full after the 24th, and several times flooded; clay lands perfectly saturated, and all farming operations suspended; very little wheat sown.

BOSTON.—A wet, dull, cold month, ground completely saturated, and all farming operations at a standstill; the latter part of the month was very stormy, but no damage was done in this neighbourhood. Although water is standing in all the low places, there have not been any great floods here. S on 24th, 27th and 30th.

GRIMSBY, KILLINGHOLME.—Weather very unsettled, but mild for the season; strong gales on the 25th, 26th, and 27th. The continuous wet is causing farmers much anxiety.

ARDWICK.—On the whole an unpleasant month; there was very little frost, but it was gloomy and wet, especially towards the end. On the 24th there commenced a series of severe storms, which lasted over four days, doing a great deal of damage.

ARNCLIFFE.—Violent storm on 26th, 27th, and 28th, and on the latter day the highest flood in the river ever remembered.

NORTH SHIELDS.—A cloudy month with a good deal of fog; very stormy on 26th with S.

WALES.

HAVERFORDWEST.—A month of great and sudden changes; commencement very mild and relaxing; at times very cold; again very stormy and wet, blowing sometimes with terrific violence. On 2nd, at noon, T, with very bright L; frosty from 3rd to 10th, on which night the darkness was intense, followed by a furious gale, with torrents of R, which lasted one hour, suddenly ceasing. Large lunar halo on 18th, followed by storm; again very stormy from the 25th to 29th, the wind blowing with hurricane violence, and R excessive. Altogether, one of the most stormy and squally Januarys recorded during the last thirty-five years; nights remarkable for the low temperatures on grass.

LLANDUDNO.—The month, though rather dull and showery, was mild; mean temp. slightly above the average, and rainfall slightly below it; only four nights of frost. Several heavy gales of wind, especially from the 25th to the 28th inclusive. Only 50·4 hours of bright sunshine.

SCOTLAND.

CARGEN.—Very dull throughout, and very stormy towards the end ; mean temp. 40°·0, 2°·0 above the average ; 49 hours sunshine, 15 hours below the average.

HAWICK.—An open month, and all agricultural operations have been pushed forward ; blackbird in full song on 24th ; snowdrop and aconite in bloom at the close. The 11th and 12th were both singularly dark days ; strong winds on 19th, 23rd, and 27th ; heavy snowstorm on 24th.

ABERDEEN.—Good seasonable weather throughout the month ; rainfall not much above the average. Auroræ seen on three nights ; prevailing winds S. to S.W.

SLIGACHAN.—The weather during the month was very favourable ; cattle and sheep doing well ; very fine from 6th to 11th.

CULLODEN.—The weather during the month was very severe, and work of every kind is much in arrear ; but little R fell between the 2nd and 17th, and the fall of S was inconsiderable.

SANDWICK.—Temp. above, and rainfall below the average ; the ground was covered with S on 26th and 27th ; some strong gales of wind occurred, and auroræ were seen on six nights.

IRELAND.

DROMORE CASTLE.—A month of perpetual R and storm ; heavy gale on the night of the 28th, L on 24th, S on 26th.

WATERFORD.—The month was remarkable for heavy gales, which often lasted for a considerable time, principally from S.W. Rainfall a good deal above the average ; primroses in bloom on 14th ; H on 14th and 24th ; very large lunar halo on 18th ; S on 25th and 26th.

KILLALOE.—The month was wild and wintry in the extreme, and the rainfall much above the average.

DUBLIN.—An open, rainy, stormy month. Mean temp. 42°·7, about 2°·0 above the average of 18 years ; the rainfall and number of wet days were also both above the average ; mean pressure, 29·729 ; humidity, 86 ; and amount of cloud, 6·0 ; prevailing winds S.E., S.W., and W.

BALLINASLOE.—The month was very wet and stormy throughout, and there were constant floods. The river rose 3 ft. above its ordinary summer level; no attempt at agriculture possible.

LONDONDERRY, CREGGAN RES.—Latter part of the month rather stormy ; S fell occasionally from 24th to 26th ; on 27th a heavy gale passed over this district from the W., and there were other gales on four occasions.

OMAGH, EDENFEL.—The first week was remarkably mild and fine, the mean temp. of New Year's Day being 11° above the average of twenty years. The remainder of the month, however, was signalized by almost continuous R, and storms, culminating during the last week in a violent gale, with S and sleet squalls.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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FOG GAUGES.

OUR first intention was to give to this article a new title, the Greek equivalent of the above, but the words do not seem to us to form a happy compound. Ομίχλη Μέτρον, or Omiklemeter, is, we think, far less likely to meet with general acceptance than was Ombrometer, and we all know how thoroughly it has been routed by the simple words "rain gauge." Hence, unless some of our readers can suggest a sonorous title, we shall leave Fog Gauges as the name of what we want.

Of late years much time and much money have been spent in recording "Duration of Sunshine"; we are not about to impugn the wisdom of that course; sunshine is undoubtedly a very important factor in the climate of any place, and we sincerely hope that some one meteorologist will make the subject his speciality, will endeavour to collect all the observations that are made, and to tabulate the results on a uniform system. It is sheer nonsense, and waste of time and money, to make observations unless there is some organization and guarantee that they will be utilized. If no one will volunteer to undertake, gratuitously, the reduction and tabulation of all these records, then the observers should discuss what is best to be done. We believe that from 50 to 100 sunshine recorders are at work in the British Isles; it may be that the Meteorological Council may consider this a subject for which they might make a grant from their £1,000 for special researches; and we think that recorders of sunshine would do well to ascertain the views of the Council on the subject. Should the Meteorological Council decline to do more than discuss the records of the instruments which they have themselves established, we think that the observers should (always on the hypothesis of no one volunteering to do the work) make a small uniform subscription, and engage a computer to discuss the whole of the records. But this hypothesis of the Meteorological Council printing one analysis of the records obtained by themselves, and of somebody else printing another analysis of other records, would be a terrible specimen of how *not* to obtain the best results from existing material.

We have treated this matter at some length for two reasons: (1) because the subject is nearly new, and at present is easily grasped

and organized, but if the observations are left uncollected they will soon become too voluminous for any one to deal with, and they will be *wasted*; (2) because the subject to which we wish to draw attention is precisely parallel, differing only in the fact that we see no reason for the apparatus costing a quarter of what a sunshine recorder costs, and if so the observers are sure to be more numerous, and the necessity for a perfect organization to collect and tabulate the records greater proportionately.

Some persons are quite content when they have made an observation and entered it in their book, and if they have sent a copy of it to any society or public body they feel that they have done a meritorious act. So, to a slight extent, they have; but until those observations are tabulated and discussed, what is the world the better?

For this reason we are always extremely careful never to ask for (and we not infrequently actually refuse) observations, unless we are prepared to give the time and thought needful for their discussion.

Our main object in the foregoing remarks has been to state clearly our views upon the important subject of the utilization of observations, and to emphasize the statement that, while we hold the subject (on which at last we are about to enter) to be of high importance, we do not invite any one to commence observations until a definite arrangement has been come to as to the collection, discussion, and publication of the results.

It has long appeared to us a matter for regret that no systematic records have been kept of the amount of fog, and that examination has been almost entirely buried under vituperation. We can recall scarcely any articles or treatises on the subject of fog-distribution except three short papers, two in the *Reports of the British Association* for 1861 and 1862, and the other an abstract of a Friday evening lecture by Dr J. H. Gladstone, F.R.S., on "Fogs and Fog Signals," in the *Proceedings of the Royal Institution*, 1863.

Bearing in mind the difficulty of obtaining a copy of the latter paper, and the exceptional fitness (if the expression is permissible) of Dr. Gladstone (both from his scientific skill, and from his position as one of the Royal Commissioners on Lights) to treat this subject, we reprint the more meteorological portion of the paper as a basis for our plea for Fog Gauges.

ON FOGS AND FOG SIGNALS, BY J. H. GLADSTONE, ESQ., Ph.D., F.R.S.

"During the course of the inquiry made by the Royal Commission on Lights, Buoys, and Beacons, the attention of my colleagues and myself was called to the fog signals which form part of the apparatus of many lighthouses, and of all British light-ships. In the report we expressed our conviction, 'that they are not sufficiently powerful, and recommend the provision of a more efficient warning in fog as subject of investigation and experiment.' About the same time, some scientific men in Ireland stirred in the matter, and induced the

British Association to appoint a committee, at the head of which is the Rev. Dr. Robinson, of Armagh, to bring the importance of the subject more directly under the notice of the legislature. These circumstances led me to turn my attention to fog; and I propose now to lay before you some of the results arrived at, with reference both to the meteorological phenomenon itself, and to the means adopted for preventing its disastrous consequences among the vessels that sail along our shores.

"I have received voluminous returns of the occurrence of fog at about 250 stations, for which I am indebted to the kindness of the three general Light-house Boards,—the Trinity House, the Northern Commissioners of Lighthouses, and the Ballast Board of Dublin; also to the Board of Trade, through Admiral Fitz Roy; and to Mr. Glaisher. I wish here also to express my thanks to several gentlemen who have aided me in the preparation of this discourse, especially Mr. Alexander Cuningham, who has just read a paper on the subject at the Royal Scottish Society of Arts, and to our friend Professor Wheatstone.

Fogs.

"A fog is simply a cloud resting on the earth. In the first discourse of the present season, Professor Tyndall explained the formation of clouds from the aqueous vapour in the atmosphere; and defined a cumulus as 'the visible capital of an invisible column of saturated air.' A fog is the capital without the column. It is the moisture evaporating from the warm earth, or river, or sea, condensed at once by the colder air. Mr. Glaisher told us here how, from his lofty position in the balloon, he saw a fog following all the windings of the Thames. This is a frequent observation, and it reminded me of a scene from the summit of the Righi one morning last summer. There lay in the valley of the Reuss a mist like a white sheet on the ground, but as the sun began to exert his power, and a light breeze to spring up, the uniform layer began to break into regular masses, and soon far beneath us there stretched a cirrus cloud, identical in aspect with those we so often see in the highest regions of the atmosphere.

"Fog, then, is composed of minute particles of water, most likely in a globular form, for there seems to be no ground for the popular notion of vesicles of vapour. Smoke enters largely into the composition of that peculiar yellow fog which visits London a few times each year—a fog of wonderful darkness and quietness, and strangely bewildering.

"This condensed vapour has a great effect in obstructing the passage of light; the sun himself cannot look through it. A slight mist seems to attack principally the more refrangible rays of the spectrum, so that the light appears redder than usual. I once analysed with a spectroscope the rays which reached Worthing from the great revolving light on Beachy Head, twenty-eight miles distant, and found that those only situated between Fraunhofer's lines C and F were transmitted. This was on what would be called a clear summer night. An objection has been raised against the orange-red glass used in many of the French lighthouses, that in misty weather all bright lights are reduced very nearly to that colour, and thus the distinction is lost; a misfortune that could hardly happen with the deep-red glass employed for the red lights of the British Isles. When the sun shines through a cloud or mist, we do not detect those atmospheric lines which make their appearance when his disk is near the horizon. Yet I have observed in London, when the sun at a

considerable altitude loomed red through a slight fog, that the characteristic C 6, δ, and η were visible.

"There is, of course, every conceivable gradation between the lightest haze and the densest fog, and it is a difficult matter to draw a line of distinction between fog and mist. The value of the meteorologieal returns in my possession depends greatly on this, and there is reason to fear, even from internal evidence, that one lighthouse keeper calls by the name of fog what another keeper thinks sufficiently described as mist or haze. Yet these keepers have a certain general sentiment and similarity in their way of thinking, and with many the practical definition of a fog is when it is necessary to sound the signal. Among amateur observers on land the greatest discrepancy prevails; but nautical men seem to have a general agreement as to what amount of thickness is to give a claim to the designation fog. For such observations Mr. Cuningham suggests that a pole, painted vermilion, should be set up at a hundred yards from the station, and that such an amount of mistiness as renders it invisible should alone be named fog. The colour of the pole should, of course, be in strong contrast to the objects behind it. This definition is somewhere about that practically adopted by seamen; it has been accepted by Mr. Glaisher, and it is hoped that it will be generally adopted by all observers.

"From the returns received, the following deductions may be drawn:—

"I. While many fogs are quite partial in their character, others cover a large extent of country. The irregular distribution of a London fog is a matter of frequent observation. Thus, last Tuesday, the day of the royal wedding, one of the densest yellow fogs obscured Westminster, whilst at Bayswater there was nothing more than a murky mist. The long-continued fog of November last in London, extending from the 19th to the 25th, was observed also at Berkhampstead, Oxford, and Banbury, but other parts of England seem to have been clear. The occurrence of fog at the lighthouse stations all round the coast during the first six months of the year 1861 has been especially studied, and the fogs of that April have been represented on a map. Some of them cover large portions of the British Isles. For instance, that of the 14th stretched all round Ireland, except the south-west corner, crossed the Irish sea to the headlands of Wales and the south-western isles and coasts of Scotland, and made its appearance again across the mainland in the Firth of Forth.

"II. Some months are marked by fogs much more than others. For instance, along the south coast of England, February and September are comparatively free, while January and June are foggy months. November is notorious for fog in London, but does not seem to deserve that character elsewhere.

"III. Some years are much more visited by fogs than others. For instance, 1861 was freer than 1858 along most parts of the coast.

"IV. Different localities are very variously visited by fog. England does not deserve that pre-eminent character for mistiness which is attributed to it by the popular imagination of the Continent. The value of the returns in showing the relative distribution of fog in different places is seriously affected by the different standards in the minds of the observers, but the following points seem pretty clearly made out:—A fog is more uniformly distributed over the surface of the sea than on the adjoining coasts. Fog is not particularly prevalent about sandbanks, or low headlands; but where cliffs or high hills

catch the south-west wind just after it has swept the ocean, as at the Isle of Wight, the Start Point, Lundy Island, and the Rocks of Pembrokeshire, the numbers run very high. The highest return is from Barra Head, the southernmost point of the Hebrides, where winds surcharged with moisture from the Gulf Stream strike the cold northern rocks, and wrap them in cloud or fog."

We now have to face the practical question—What is the best mode of determining the density of a fog?

The only suggestion mentioned by Dr. Gladstone is, that by Mr. Cuningham, of a vermillion coloured post. We do not understand why it was to be vermillion. If it had been bands of red and of white, we could understand it, for red, unless strongly illuminated (which it would not be in a fog), looks black, but surely black and white would be a better contrast.

The visibility of the pole will, as is stated, depend upon the back-ground. And, therefore, in the first place, if we are to obtain uniformity, we must have a uniform back-ground, and that can be obtained only by employing an artificial one. Hence we think that a broad board painted with stripes, is better than a pole.

When there is much fog, the sun has rarely much power, but if the fog be thin, there is usually extra illumination of the southern half of the sky, and hence it will be desirable that the boards at all stations should face one way, viz., towards the South, so that they may have the greatest illumination.

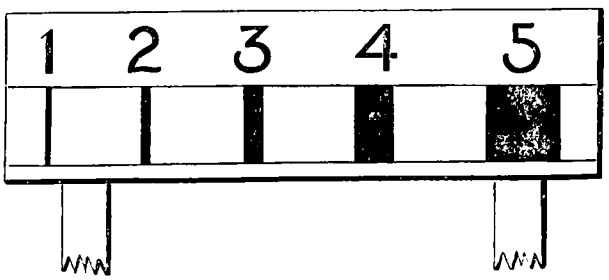
In towns it may often be impossible to have the board at a distance of 100 yards due North of the observer, and we do not think that so great a distance is needed. In some London fogs, all distinctions of colour, even of white on black varnish at less than a tenth of that distance, and we see no reason for adopting so great a distance.

It appears to us both desirable and practicable to obtain something more precise than a mere record of fog or no fog, according as one special object is or is not visible; and we should like to see an apparatus which by day or by night, would indicate no fog, slight fog, moderate fog, dense fog.

Mr. Cuningham's pole cannot be assumed to be more than 4 inches in diameter, and such a pole at the distance of 100 yards would subtend the very small angle of 3′ 49″. As already mentioned, we see no advantage in the gauge being so distant from the observer as 100 yards, 300 feet; for surely the measure of obscuration depends on the angle subtended by the object, and a black line 0·4 inch broad on a white board at a distant of 30 feet, would subtend just the same angle as one 4 inches broad at 300 feet.

As Dr. Gladstone says, that such a pole as has been proposed, seems to correspond with the ordinary definition of fog, we think it would be well to accept its equivalent or (0·27 inch) $\frac{1}{4}$ inch at 20 feet, as the breadth of No. 1 of the fog scale; and the subsequent numbers might be multiples of it, *i.e.*, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2 and 4 inches. Our board should be horizontal, not vertical, so that all parts of the scale

should be under identical conditions, and it should, we think, never be less than 5, nor more than 10 feet above the ground. It would be necessary to have the scale figures painted on it to ensure the entry of the true values, and would, therefore, look somewhat as per sketch.



The measurement of the intensity of fogs at night, is far easier, because it is not complicated by the varying illumination in the day time due to clouds. We have for many years used street lamps as fog-gauges; but owing to variations in the volume of flame, they are far from perfect, and are by no means everywhere available.

It seems to us that the most simple and effective plan will be to have some small lanterns made of tin, to hold a piece of composite candle; (all such candles give an approximately equal flame), and fitted with a groove, into which could be dropped one, two, three, or four thicknesses of coloured glass. In the densest fog, such a light would even without any coloured glass be invisible at about 30 feet (perhaps at 20 feet, but we are not sure), and the density of the fog would be determined by placing the lamp at a distance of 20 feet, with all the thicknesses of glass superposed, and removing them one by one until the light became visible; *e.g.*, if when all four were in, the light could be seen, there would be no fog; with three in, it would be No. 1; with two, No. 2; with one, No. 3; with none in No. 4; and if the naked light could not be seen, it would be a maximum fog, or No. 5. Of course, all the lanterns must be alike, and the glasses of equal tints, but that could easily be arranged.

Some persons may think that the Spring is a curious period at which to suggest observations on fogs, but we consider that it is very appropriate, because it leaves ample time for considering and discussing the subject, and for preparing and fixing the apparatus, if any experiments be decided upon. We have laid our own notions before our readers, and trust that they will not hesitate to criticize them as severely as they can, because all that we desire is, that something should be done towards systematizing the records of fog.

REVIEWS.

Elementary Meteorology, By ROBERT H. SCOTT, M.A., F.R.S.; 8vo. xii–408 pages. London: Kegan Paul, Trench & Co., 1883.

SOME phrases become by repetition so hackneyed, that one hesitates to use them, but in spite of that objection, we say at the outset, that "this work supplies a long-felt want." Herschel's *Meteorology* has not been revised since 1861, and even then was a theoretical rather than practical work; and Buchan's *Handy Book of Meteorology*, second edition, 1868, has long been out of print, and extremely difficult to obtain even second-hand. "Elementary Meteorology" is sound, interesting, and cheap. Of course, there are in it a few mistakes, but the following list of those we have noticed will show how trivial they are. On page 26, it is stated that if spirit passes the mercury in a Six's thermometer the two ends will indicate different temperatures. Unfortunately, they will not, inasmuch as one scale reads upwards and the other downwards, so that a Six may be 10° wrong on both legs, and there would be nothing to show it. On page 102 we have "Cole" for "Collin." On page 132 we have one of those amusing cases which constantly occur when distinct claims of priority are enunciated—Mr. Scott alludes to this difficulty in the preface, it is a very real one, and we put matters right in all possible good humour. The author is writing concerning improvements in rain gauges, and mentions as the chief,

"the addition of a vertical cylinder on the top to retain snow when it falls, and prevent its being blown out of the gauge as would be very likely to happen if the funnel was shallow. This improvement was devised by the Meteorological Office in 1868. Such gauges are known as Snowdon gauges."

As the Meteorological Office has never had anything to do with Snowdon, we are rather surprised that the name did not suggest the possibility of the plan having some earlier origin. The fact is, Snowdon pattern funnels were designed for use in Snowdonia, and erected in 1864. The following extract from the British Association Report, 1866 (p. 344), disposes of the matter:—

"These and all other gauges in North Wales started under the joint auspices of Captain Mathew and Mr. Symons, are made with a cylinder about five inches high, rising from the rim, whereby snow is more adequately measured."

The best part of the story is yet to come, for neither of the above parties was the first to adopt the plan, it was used by Quetelet in the first half of this century, and in his *Climat de la Belgique* will be found an engraving of a Snowdon funnel. Well might Mr. Scott write in his preface, "If, in any case, full credit has not been given to the first discoverer of any principle, I must only beg him to accept my apologies for the omission."

On page 137 "St. Paul's Churchyard" should be struck out, and "Camberwell" substituted.

We said that the errors were few and trivial, and to have found only these four in upwards of 400 pages is a somewhat remarkable confirmation of our statement. The author's large acquaintance with

German Meteorological literature has added greatly to the solidity and importance of his book; for instance, the Isothermal charts of the globe have all been redrawn in accordance with the values given by Wild in his splendid work on the distribution of temperature in Russia, and large quotations have been made (duly acknowledged) from Dr. Hann's *Physical Geography* and Professor Mohn's *Outlines of Meteorology*.

Mr. Scott has done good work in writing the book; we hope that Meteorologists will do their part by reading it carefully through, and never passing a chapter until it has been thoroughly mastered.

Etude sur le climat de l'Algérie), *Température, Pression barométrique et Pluie.* Par M. ALFRED ANGOT. 4to. Paris: Gauthier Villars, 1883.

THIS is an excerpt from the Annales of the Bureau central météorologique de France, but it is complete in itself and of considerable interest—not merely to the British "swallows" who flock to Algiers in considerable numbers, but to meteorologists at large, and even to students of the general physics of the globe, for M. Angot's maps include a tract of Northern Africa and Southern Spain and Italy, including about 20° of longitude, and 5° of latitude. Here, by the bye, we have a small complaint to make. The publications of the French Meteorological Office are distinguished by general excellence of printing and paper, and most of all, by the execution of their maps, and those illustrating the present memoir fully maintain the reputation of the Bureau, but there is one too few; there should have been one showing the sites of all their stations.

The paper is divided into the following sections:—1, Physical description of the country; 2, Air temperature; 3, Atmospheric pressure; 4, Rainfall.

We cannot dwell upon the memoir at any length, but may state briefly that M. Angot has collected all the trustworthy observations which he could find, but has used those only which have been made during the period 1860-79. For that period he has determined the most important elements of the above subjects, and, as far as we have noticed, has in every case adopted the best plan for ensuring accurate results. Some of the values agree to an extent which is almost marvellous, *e.g.*, speaking of the reduction of barometric readings to their equivalent sea level pressures, M. Angot says, "The numbers thus obtained have all been reduced to sea level by the tables, which I printed in the *Annales du Bureau central météorologique pour* 1878. It may be interesting to mention that even for stations at an altitude of more than 1000 metres (3281 feet), such as Sétif, 1086 m. (3563 ft.) and Géryville 1306 m. (4285 ft.), the annual mean, reduced to the level of the sea, agrees with that at the low stations, within some tenths of a millimetre."

A tenth of a millimetre is 0·004 in., and taking the most unfavour-

able view of the case, namely, that "some tenths" should be interpreted to mean nine-tenths, that would only be 0·035 in., and although we partly share Mr. Knox Laughton's objection to sea level isobars running over mountains nearly a mile high, we congratulate M. Angot on this double-edged evidence of the goodness of his tables and of the Algerian observations.

As regards temperature, the mean temperature of the coldest month at the coldest station, excepting those on the hills, may be taken as 48°, and the mean of the hottest month at the hottest station as 90° F., which is nearly as high as any place on the globe. The precise values are, Military Hospital, Biskra, Lat. 34° 51′ N., Lon. 5° 40′ E., altitude 410 feet, mean temperature for July, based on 15 years observations (32°·2 C) 90°·0 F.

The rainfall has been observed at many more stations than the temperature and pressure. In fact, for the period under discussion, 1860-79, M. Angot has obtained rain records from 57 stations, each of the average length of 13 years, or a total of 735 yearly records. We should have been glad to see a table containing all the perfect yearly totals, as, although the period is not very long, it would have been both interesting and useful to have seen whether any, and if so what, regularity could be traced in the sequence of wet and dry years; in short, to have enabled us to bring down to 1879 a table analogous to the one on pages 50-51 *Meteorological Magazine*, Vol. V., 1870, which we converted from a memoir by Prof. Raulin. We should also have been glad of a column stating the height of all gauges above the ground.

M. Angot's attention has been devoted chiefly to obtaining trustworthy and comparable mean monthly and yearly values, and for that purpose he has adopted the best methods possible. We, therefore, thought that it would be well to compare the results now given with the arithmetical means given fifteen years ago. Having carried out such a comparison, we are glad to find that the differences are almost always insignificant. There is one station for which the values are terribly discordant, viz., Bougie, of which M. Raulin gave the rainfall as 51·82 in., and M. Angot gives 40·91. The only other important differences are (1) at Algiers, for which Professor Raulin gave two records of 31 and 35 inches respectively, and M. Angot gives five returns ranging from 24½ to 30 inches, and averaging about 28 inches; (2) at Constantine, which Professor Raulin gave as 27 inches, and M. Angot brings down to 22 inches

The author has given a very useful table of the percentage of the mean yearly total which usually falls in each month, and our only regret in connection therewith is, that he did not give a sheet of curves representing the numerical values.

Lastly, we must draw especial attention to the excellent series of 40 maps, viz., Isotherms, Isobars, and Isohyetals for each month, and also for the year, as well as one map showing the average number of days with rain.

THE RECENT FLOODS IN WESTERN EUROPE.

To the Editor of the Meteorological Magazine.

SIR,—I have only just got the following return of Swiss rainfall, and regret that it is not complete.

Chexbres is about six miles East of Lausanne, and the greater part of its rainfall flows northward to the Rhine.

Oron is about six miles north of Chexbres, in the valley of the Broye, which runs northwards to Morat and the Rhine.

Both these places had more rain than Lausanne, and the fall in their district would materially affect the Rhine.

Sincerely yours.

MICHAEL FOSTER WARD, F.M.S.

Hess Strasse, Munich, March 2nd.

RAINFALL IN SWITZERLAND.

DATE.	Geneva.	Lausanne.	Chexbres.	Oron.	Montreux.	Chessel.
December 22, 1882 ...	·59	·59	·56	·62	?	·35
,, 23	·78	·73	·99	1·13	1·82	·62
,, 24	·13	1·02	·86	·47		·58
,, 25	·33	·09	·20	·07		·13
,, 26	·46	·47	·67	·79	·77	·60
,, 27	·93	·56	1·24	1·60	·55	·78
,, 28	·01	·44	·67	·41	?	·28
,, 29	...	...	...	...	?	...
,, 30	...	...	...	...	?	...
,, 31	·42	·03	...	...	?	...
January 1, 1883 ..	·16	·55	?	1·00 ?	?	?
,, 2	·06	·04	?		?	!
,, 3	·03	·14	?		?	?
,, 4	...	...	?		?	?
Totals from 24th ...	2·53	3·34	3.64?	4·33 ?	2·24 ?	2·37 ?
Gross total.....	3·90	4·66	5·19?	6·08	3·24 ?	3·34 ?

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held at the Institution of Civil Engineers on Wednesday evening, February 21st; Mr. J. K. Laughton, F.R.A.S., President, in the chair. Rev. W. R. C. Adamson, R. P. Coltman, W. F. Gwinnell, Captain C. S. Hudson, T. Mann, F. G. Treharne, and W. Tyson were balloted for, and elected Fellows.

The following papers were read :—

1 Notice of a remarkable land fog bank, "The Larry," that

occurred at Teignmouth, on October 9th, 1882," by G. W. Ormerod, M.A., F.M.S. The "Larry" is a dense mass of rolling white land fog, and is confined to the bottom of the Teign valley, differing therein from the sea fog, which rises above the tops of the hills; it appears about day-break, and has an undulating, but well-defined upper edge, which leaves the higher part of the hill-sides perfectly clear. The author gives an account, illustrated by photographs, of the remarkable fog-bank that occured at Teignmouth, on the morning of October 9th.

2. "Barometric depressions between the Azores, and the continent of Europe," by Captain J. C. de Brito Capello, Hon. Member M.S. The author gives the tracks of several depressions from the Azores to Europe, and shows that if there had been a telegraphic cable, the arrival in England of nearly every one of them could have been foretold.

3. "Weather Forecasts and Storm Warnings on the coast of South Africa," by Captain C. M. Hepworth, F.M.S.

4. "Note on the reduction of Barometric readings to the gravity of latitude 45°, and its effect on secular gradients, and the calculated height of the neutral plane of pressure in the tropics," by Professor E. D. Archibald, M.A., F.M.S.

FISHERY BAROMETERS.

To the Editor of the Meteorological Magazine.

SIR,—Turning over an old "Mechanics' Magazine" (vol. xxx. p. 30) last evening, I came upon a letter signed "F.R.S.," suggesting that public barometers should be placed in conspicuous positions in seaport towns and fishing villages. The date is 1838, which seemed to me early. The writer stated that he had seen such a barometer at Geneva.

In a subsequent number (vol. xxx. p. 52) "Nauticus" writes to say that he has seen fishermen and others habitually consulting the barometers in opticians' shops, so that the establishment of public instruments would no doubt meet a want.—Yours very truly,

RICHARD B. PROSSER.

31, St. Paul's Road, March 9th, 1883.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCT., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	70·4	1	31·9	26	58·0	44·5	46·5	85	116·7	27·2	4·96	23	7·7
Cape of Good Hope	91·8	23	40·2	31	72·8	48·2	51·7	75	..	...	3·07	10	4·6
Mauritius	78·7	21	66·1	27	77·8	68·6	61·6	69	...	...	·91	18	5·1
Calcutta	90·6	10	67·6	22	85·6	73·9	74 0	85	155·9	58·0	11·08	9	4·5
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	91·5	26	71·0	30	87·0	75·0	73·6	78	149·0	59·2	1·12	3	2·9
Ceylon	87·6	20	72·8	24‡	84·7	76·0	71·9	75	150·6	68·0	11·72	21	8·0
Melbourne	86·0	16	36·1	11	69·5	47·9	44·8	64	138·0	27·2	2·04	8	4·8
Adelaide	94·8	30	39·4	3	73·8	51·1	46·8	56	158·8	34·5	1·65	11	4·5
Wellington	67·0	11	40·0	7‖	59·1	46·6	...	..	127·0	37·0	2·68	13	...
Auckland	67·4	27	43·5	26	63·1	49·1	48·3	75	131·5	36·0	1·62	16	6·2
Falkland Isles	57·7	24	30·1	28	48·8	36·9	40·3	86	120·0	25·6	2·15	16	7·0
Jamaica	89·4	27	69·7	16	87·2	72 7	73·3	84	...	64·1	6·39	...	5·5
Barbados	86·0	21	70·0	30*	82·5	73·0	73·4	80	153·0	68·0	5·84	19	6·0
Toronto	74·3	7	28·0	20	60·5	42·6	46·0	75	140·0	21·0	1·15	8	5·2
New Brunswick, S. John	63·0	10†	31·0	12	54·1	41·7	44·1	85	...	...	3·35	12	5·5
Cape Breton, Sydney	71·8	9	30·0	13	56·1	41·7	44·5	85	...	...	5·38	15	5·6
Manitoba, Winnipeg	68·3	5	21·3	31	50·5	32·6	37·8	82	118·0	...	3·97	13	6·5
British Columbia	...	...	...	...	...	...		...	...	...	...	...	

* And 31. † And 16. ‡ And 26. ‖ And 25.

REMARKS, OCTOBER, 1882.

Cape of Good Hope.—Mean temp. about 4° below the average; rainfall 2 in. in excess of the previous October. D. GILL, F.R.S.

Mauritius.—Rainfall ·76 in. below the average; mean temp. 0°·8 above it; mean pressure, 30·139 in.; mean hourly velocity of wind 12·3 miles, extremes 30·3 miles and 3·2 miles; prevailing direction E. by S. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. 0°·7 above the average; mean pressure and humidity about the average; temp. of dew point, amount of cloud, and rainfall all considerably below it; prevailing direction of wind S.E. and S.; strong breezes on eight days; dense fog on 9th; hoar frost on 11th; heavy dew on three days; L on 9th and 22nd; Aurora Australis on 2nd and 6th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (29·995 in). and temp. about the average; rainfall ·16 in. below it. Over the settled district the rainfall was about the average; in Central Australia it was heavier than usual, and many stations in the north had treble the average. C. TODD.

Wellington.—Windy and wet till 6th, generally fine from 7th to 21st, and the remainder of the month was showery with one or two fine days. On the 4th 1·10 in. of rain fell; N.W. winds prevailed on fourteen days; T on 22nd; slight earthquake on 20th; brilliant meteors on 29th and 30th. R. B. GORE.

Auckland.—Weather mostly fine, but with high wind throughout the month from S.W., occasionally veering to W. or S.; little R; temp. 1°·5 below average; bar. mostly high. E. B. DICKSON.

Falkland Isles.—Last week of month unusually cold and stormy. F. E. COBB.

BARBADOS.—Mean pressure below the average; mean temp. (77°·0) same as the average; average velocity of wind 7·5 miles per hour, extremes 16 miles and 1 mile, rainfall 62 per cent., and evaporation 36 per cent., above the average. Sixteen days were overcast; TSS on 5th; L on 12th, R. BOWIE WALCOTT.

CAPE BRETON.—On 19th 1·71 in. of R fell. C. CARPMAEL.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	5·19	XI.	Llanfrechfa Grange	4·99
,,	Margate, Birchington...	2·44	,,	Llandovery	6·71
,,	Littlehampton	3·68	,,	Solva	3·48
,,	St. Leonards	3·41	,,	Castle Malgwyn	9·35
,,	Hailsham	4·30	,,	Rhayader, Nantgwillt..	9·86
,,	I. of W., St. Lawrence.	3·43	,,	Carno, Tybritle	5·12
,,	Alton, Ashdell.....	6·61	,,	Corwen, Rhug	4·52
III.	Great Missenden.....	4·53	,,	Port Madoc	4·53
,,	Winslow, Addington ...	4·01	,,	I. of Man, Douglas	2·36
,,	Oxford, Magdalen Col...	3·60	XII.	Carsphairn	8·40
,,	Northampton	3·26	,,	Melrose, Abbey Gate...	2·97
,,	Cambridge, Beech Ho...	2·39	XIII.	N. Esk Res. [Penicuick]	1·60
IV.	Southend	1·93	XIV.	Ayr, Cassillis House ...	3·31
,,	Harlow, Sheering	3·55	,,	Glasgow, Queen's Park.	...
,,	Diss	2·37	XV.	Islay, Gruinart School..	4·83
,,	Swaffham	3·19	XVI.	St Andrews, Newton Bk	3·72
,,	Hindringham	3·20	,,	Aberfeldy H.R.S.	7·53
V.	Salisbury, Alderbury...	4·89	,,	Dalnaspidal	6·83
,,	Warminster	5·12	XVII.	Keith H.R.S.	2·16
,,	Calne, Compton Bassett	3·98	XVIII.	Forres H.R.S.	1·47
,,	Beaminster Vicarage ...	5·63	,,	Strome Ferry H.R.S....	6·35
,,	Ashburton, Holne Vic..	12·38	,,	Lochbroom	5·44
,,	Torrington, Langtree W.	5·49	,,	Tain, Springfield.....	1·13
,,	Lynmouth, Glentnorne.	7·62	,,	Loch Shiel, Glenaladale	13·56
,,	Probus Lamellyn.....	7·04	XIX.	Lairg H.R.S.	...
,,	Taunton, Fullands	4·68	,,	Forsinard H.R.S.	2·80
VI.	Bristol, Clifton	4·00	,,	Watten H.R.S.	1·88
,,	Ross	4·33	XX.	Fermoy, Glenville	8·11
,,	Wem, Sansaw Hall.....	1·91	,,	Tralee, Castlemorris ...	8·06
,,	Cheadle, The Heath Ho.	2·19	,,	Tipperary, Henry Sreet	...
,,	Worcester, Diglis Lock	3·07	,,	Newcastle West	5·27
,,	Coventry, Coundon	3·50	,,	Kilrush	...
VII.	Melton, Coston	3·10	,,	Corofin	5·59
,,	Ketton Hall [Stamford]	3·05	XXI.	Carlow, Browne's Hill..	4·96
,,	Horncastle, Bucknall ...	2·90	,,	Navan, Balrath	2·74
,,	Mansfield, Market Place	3·36	,,	Athlone, Twyford	5·45
VIII.	Macclesfield, The Park	2·29	XXII.	Mullingar, Belvedere ...	3·81
,,	Walton-on-the-Hill... .	1·82	,,	Clifden, Kylemore	12·23
,,	Lancaster South Road..	3·05	,,	Crossmolina, Enniscoe..	6·46
,,	Broughton-in-Furness ..	6·14	XXIII.	Carrick-on-Shannon ...	3·18
IX.	Wakefield, Stanley Vic.	1·76	,,	Dowra	...
,,	Ripon, Mickley	3·09	,,	Rockcorry.....	2·84
,,	Scarborough.....	2·58	,,	Warrenpoint	4·63
,,	East Layton [Darlington]	2·28	,,	Newtownards	4 23
,,	Middleton, Mickleton ..	3·75	,,	Belfast, New Barnsley .	3·68
X.	Haltwhistle, Unthank..	2·46	,,	Bushmills	3·28
,,	Shap, Copy Hill	7·97	,,	Buncrana	3·19

FEBRUARY, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·62	+ 1·98	·60	8	14	57·3	28	29·3	17	4	12
II.		Maidstone (Hunton Court)...	3·43	+ 1·81	·63	8	19	...	...	...	...	...	...
,,		Strathfield Turgiss	3·88	+ 2·13	·70	10	15	54·4	21*a*	24·2	16	6	19
III.		Hitchin	3·79	+ 2·19	·77	2	19	51·0	22*b*	28·0	16	9	...
,,		Banbury	4·78	+ 2·94	1·04	10	17	54·0	22	29·0	1	6	...
IV.		Bury St. Edmunds (Culford)	3·35	+ 1·58	·59	2	18	54·0	21*b*	27·0	15	10	..
,,		Norwich (Cossey)	2·73	+ ·98	·43	10	15	57·5	24	28·5	1	6	11
V.		Bridport	4·43	...	·94	10	15	...	..	...	...	...	...
,,		Barnstaple.....	5·27	+ 2·08	1·06	1	23	55·0	15	30·5	1	...	...
,,		Bodmin	9·24	+ 4·37	2·00	1	22	50·0	14	27·0	1	3	10
VI.		Cirencester	3·96	+ 1·32	·58	10	18	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	4·22	+ 1·72	·61	1	20	56·0	21	27·0	1	3	16
,,		Tenbury (Orleton)	3·35	+ ·88	·68	1	18	57·5	24	29·0	16	5	15
VII.		Leicester	3·19	...	·69	10	20	57·0	24	31·5	16	2	16
,,		Boston	3·20	+ 1·42	·71	11	14	55·0	21	28·0	1	...	...
,,		Grimsby (Killingholme).....	2·79	+ ·99	·69	10	18	55·0	21	31·0	1, 15	2	...
,,		Hesley Hall [Tickhill].....	2·29	...	·39	10	17	58·0	25	25·0	1	5	...
VIII.		Manchester (Ardwick).....	1·62	— ·57	·39	11	15	55·0	21	28·0	1	5	...
IX.		Wetherby (Ribston Hall) ...	2·34	+ ·19	·37	8	12	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·46	+ 1·82	1·34	17	23	53·0	25	30·0	...	...	...
X.		North Shields	1·52	— ·32	·57	1	16	57·2	21	28·5	1	7	7
,,		Borrowdale (Seathwaite).....	18·20	+ 6·75	1·93	9	28	51·1	25	26·0	1	5	...
XI.	WALES.	Cardiff (Ely).....	3·93	+ ·27	·68	17	20	...	...	...	...	...	...
,,		Haverfordwest	6·36	+ 1·91	1·12	17	20	52·0	20*c*	30·0	8	6	10
,,		Plinlimmon (Cwmsymlog) ...	5·10	...	·54	9	22	...	...	...	...	...	...
,,		Llandudno.....	2·78	+ ·49	·53	13	18	54·8	21	32·2	1	...	...
XII.		Cargen [Dumfries]	4·78	+ ·97	·98	1	19	52·6	21	28·4	1	3	...
,,		Hawick	3·36	+ 1·07	·55	13	20	...	...	..	...	...	...
XIV.		Douglas -Castle (Newmains)	4·67	+ 1·50	·62	9	21	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	7·94	+ 3·55	1·71	21	24	...	...	29·0	9	7	...
,,		Appin (Airds)	5·86	...	...	...	...	...	...	...	...	...	.
,,		Mull (Quinish).....	8·16	...	1·58	17	26	...	...	...	..	...	...
XVI.		Loch Leven Sluices	2·40	— ·56	·60	2,3	9	...	...	...	...	...	...
,,		Arbroath	2·89	+ ·73	·66	17	16	53·0	24	30·0	1	4	...
XVII.		Braemar	6·11	+ 3·44	1·04	2	21	50·0	21	24·2	11	7	17
,,		Aberdeen	4·14	...	1·16	17	20	59·0	21	30·0	1	3	...
XVIII		Skye (Sligachan)	15·76	...	2·52	17	24	...	...	...	...	..	...
,,		Culloden	1·78	+ ·73	...	...	...	53·0	24	26·5	2	4	20
XIX.		Dunrobin	1·90	...	·38	26	11	52·2	24	28·0	19	...	...
,,		Orkney (Sandwick)..... ..	3·46	+ ·91	·85	2	19	47·8	24	31·8	2, 11	2	7
XX.	IRELAND.	Cork (Blackrock)	9·10	+ 4·51	2·07	16	18	56·0	27*b*	28·0	18*d*	10	...
,,		Dromore Castle	8·97	...	1·15	6	19	56·0	28	30·0	8*e*	6	...
,,		Waterford (Brook Lodge) ...	6·83	...	1·46	1	18	54·0	25*b*	22·5	1	8	...
,,		Killaloe	5·43	...	·84	1	19	60·0	28	26·0	1	12	...
XXI.		Portarlington	2·63	+ ·42	·48	6	17	57·0	21	28·5	1	4	...
,,		Dublin (FitzWilliam Square)	3·75	+ 1·59	1·01	1	17	57·9	21	29·1	19	2	7
XXII.		Ballinasloe	4·49	+ 1·98	·65	16	24	54·0	28	26·0	1	14	...
XIII.		Waringstown	3·02	+ ·77	·48	11	17	55·0	21	28·0	18	7	11
,,		Londonderry (Creggan Res.).	3·19	...	·75	17	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·40	+ 1·12	·84	17	22	51·0	21*b*	29·0	18	9	...

\+ Shows that the fall was above the average ; — that it was below it.

a And 24. *b* And 28. *c* And 21. *d* And 22. *e* And 9, 12, 18, 21.

METEOROLOGICAL NOTES ON FEBRUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The first three parts of the month wet and cold, the last week bright, fine, and dry. Flood water subsiding, and should the weather continue fine, the spring sowing may begin at last; a state of affairs wholly unparalleled in the history of this country's agriculture. Honey bees at work on 8th; white violets in flower on 13th; daisy on 18th; white dead nettle on 21st; buttercups on 26th.

BANBURY.—Very stormy during the first half of the month; weather unusually mild, but vegetation not forward; whitethorn hedges in bud at end of month; mean temp. 42°·2, bar. at noon, on 23rd, 30·815 in., high wind on eight days, very wild on 14th; floods on 3rd.

CULFORD.—Very wet during the early part of the month, preventing outdoor pursuits, wheat perishing from excessive wet; the close of the month was fine, but there was very little sunshine.

BODMIN.—Mean temp. 43°·9; rainfall much the greatest registered here in February; on 24th, bar. rose to 30·870 in., the highest point I have registered during 24 years.

CIRENCESTER.—A mild month, with excessive R and floods.

WOOLSTASTON.—Constant gales, rain, and floods during the earlier part of the month; the last week was very fine, and the land beginning to dry rapidly by the end of the month; mean temp. 41°·6.

ORLETON.—S fell on the night of February 1st, changing to R, which filled the rivers; the weather continued very rainy till the 20th, with occasional sunshine, but only three days without R, the land being perfectly saturated, and the rivers frequently overflowing. After the 20th, the bar. was very high, and the weather dry and fine. Mean temp. of the month more than 2° above the average. Lunar halos were seen on 16th, 19th, and 21st. Wheat planting became general at the end of the month.

GRIMSBY, KILLINGHOLME.—The month was very wet till the 17th, and no field work could be carried on, but after that date, the weather was dry and fine. Bar. very high on 23rd.

ARNCLIFFE.—Very stormy on the nights of the 6th and 12th.

SEATHWAITE.—Very stormy and wet from 11th to 15th; during the month there were eight falls of rain exceeding one inch in 24 hours.

WALES.

HAVERFORDWEST.—The month commenced cold, stormy, and wet, with a great depression of the bar. (9 a.m. on 2nd, 28·764), heavy squalls of R and wind occurred on the 6th and 7th, most violent from 10 to 12 p.m.; the 9th also was very stormy with heavy rainfall, and this weather continued till the 14th; two fine days of sharp frost followed, and on the 17th, another violent storm of R and wind occurred, the spring tide and flood meeting caused one of the highest floods known for several years. After the 17th, the weather gradually, but steadily improved, and from the 20th to the end of the month, the bar. was remarkably high, reaching 30·844 in., at 9 a.m. on 23rd. The third wettest February during the last 35 years.

LLANDUDNO.—A fine mild month with no frost, and both the daily and monthly range of temp. (9°·0 and 22°·6 respectively), were less than the average. Though the rainfall was half-an-inch above the average, the mean humidity of the air (83) was slightly below the average. A heavy gale occurred on the 12th. Duration of bright sunshine 87·8 hours.

SCOTLAND.

HAWICK.—A cold, wet, and windy month, strong gales from 12th to 17th. Aurora on the 24th.

BRAEMAR.—An open wet month with frequent gales of wind causing great damage to forests.

ABERDEEN.—Strong S.W. winds and gales, accompanied by heavy rains, marked the first half of the month; but after the 17th, the weather, although showery, was fine and comparatively dry. Rainfall of the month 1·70 in. above the average. Aurora seen on three nights.

SLIGACHAN.—Rather wet all the month, only four fine days, on the whole very mild; frequent gales and strong wind.

CULLODEN.—Weather generally fair, during the month R falling at intervals; no S fell, and frosts occurred only at night, and were not severe. Prevailing winds W., W.N.W. and S.W., frequently very heavy.

SANDWICK.—The rainfall of the month was above the average, the temp. was mild, but it was very stormy, there was a long-continued storm from 10 a.m. on the 6th, till 10 p.m. on 8th; velocity of wind never less than about 50 miles per hour, and about 70 miles an hour from 4 to 11 a.m. on 7th; there were gales also on 13th, 17th, 22nd, and about midnight between the 24th and 25th; S.E. winds prevailed till the 19th, and after that S.W. Auroræ seen on six nights.

IRELAND.

DROMORE CASTLE.—Perpetual storms and R prevailed during the first half of the month; the weather then gradually improved, and the last few days were very fine, with morning mists, followed by clear skies and warm sunshine. L on 7th, 12th, and 14th; S on 10th; H on 13th.

WATERFORD, BROOK LODGE.—Heavy gales prevailed during first half of the month, with R, H, and S. Rainfall much above the average. Farming operations very backward, but much was done in the last week, which was favourable.

KILLALOE.—After three weeks of constant wet and boisterous weather, the month closed with a week beautifully fine and spring like. Shannon floods up to the fullest height on 20th. S on 13th.

DUBLIN (FITZWILLIAM SQUARE.)—During the first three weeks of the month, stormy weather and heavy rains prevailed; after the 18th, fine, quiet weather (anti-cyclonic). Mean temp. 43°·4, 0°·6 above the everage of 18 years; after the 18th, only ·05 in. of R fell; S.E. gale with H on 1st; S gale on night of 12th; TS on 15th; pressure 30·802 in., at 9 a.m. on 23rd.

WARINGSTOWN.—The early part of the month was wet, the latter part very fine and drying, admitting of much lost time being made up.

LONDONDERRY (CREGGAN RES).—The month was very stormy up to the 24th, but the last four days were fine.

ERRATUM.

In the general table on page 14 (last month) for Dublin (Monkstown) read Dublin (FitzWilliam-square.)

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCVII.] APRIL, 1883. [PRICE FOURPENCE, or 5s. per ann post free.

ARTIFICIAL AURORÆ.

PROBABLY most of our readers have somewhere or other, at the defunct Polytechnic, if nowhere else, seen the beautiful imitation of aurora produced by an electric discharge through an exhausted tube. It is, however, to a far more remarkable experiment that we desire now to draw attention, but as at present we have nothing but telegrams and hearsay remarks, we purpose merely reproducing a few paragraphs respecting the experiments, and leaving them to speak for themselves.—ED.

AN ARTIFICIAL AURORA.—A telegram has been received by the Finnish Academy of Sciences from Professor S. Lemström, chief of the Finnish Meteorological Observatory at Sodankylä. He states that, having placed a galvanic battery, with conductors covering an area of 900 square metres on the hill of Oratunturi, he found the cone to be generally surrounded by a halo, yellow-white in colour, which faintly but perfectly yields the spectrum of the aurora borealis. This, he states, furnishes a direct proof of the electrical nature of the aurora, and opens a new field in the study of the physical condition of the earth. A further telegram has been received, in which Professor Lemström states that experiments with the aurora borealis made December 29, in Enare, near Kultala, on the hill of Pietarintunturi, confirm the results of those at Oratunturi. On that date a straight beam of aurora was seen over the galvanic apparatus. It also appears from the magnetic observations that the terrestrial current ceases below the auroral arc, while the atmospheric current rapidly increases, but depends on the area of the galvanic apparatus to which it seems to be proportional. The Professor regrets that with the means at his disposal further experiments cannot be made, and that he intended, on the 13th ult. (January) to withdraw the apparatus.—*Public Opinion*, Feb. 10.

SCIENTIFIC EXPERIMENTS IN HIGH LATITUDES.

The Electro-Technical Association has telegraphed to Professor Lemström, at Helsingfors, congratulating him on his important investigation of Polar lights, and expressing a warm interest in his further experiments. M. Lemström commenced his research in Spitzbergen, where he observed rays of Polar light at a lower elevation than the clouds. He had later produced similar phenomena on a small scale in his laboratory. The mountains upon which he made his last experiments were conical, and respectively 800 metres (2,625 ft.) and 1,100 metres (3,609 ft.) high. The copper framework was erected between two and three metres above the mountain-top, isolated in the usual way and conducted to the bottom of the hill by means of an insulated wire. The latter was connected with the damp subsoil by a zinc plate. The copper framework terminated in hundreds of metal points. No sooner was the wire connected

with the earth than positive currents were remarked, and a white light was observed above the metal points which, subjected to the spectroscope, distinctly showed the well-known line of the aurora borealis. Unfortunately the ice crystallised so rapidly around the wire as to damage and break it by its weight. There was full time, however, to observe the formation of a ray of Polar light about 120 metres (394 ft.) in length—*Daily Telegraph*, March 2nd.

An Artificial Aurora.

Since Franklin's famous experiment, by which he proved that a flash of lightning is only a long electric spark darting from the battery of the clouds, nothing has been done to test the nature of atmospheric electricity so praiseworthy or so interesting as the investigation by Professor Lemström described in the telegrams of our Berlin correspondent. For many years physicists have had little doubt that the Aurora Borealis was an electrical phenomenon. When a strong current is passed through a partially exhausted glass cylinder—the enclosed air of which would fairly represent the thin upper atmosphere—a soft, bright, tremulous, and variously-coloured light streams through it, for all the world like a miniature of the "Merry Dancers" of sub-polar skies. Besides this, there is the well-known fact that when the Northern Lights are visible, telegraphic indications are sadly deranged by earth-currents. This is now recognised as a constant and nearly if not quite universal phenomenon. On November 17th last, during a brilliant display of aurora, the magnetic recording instruments at Greenwich were more perturbed than they had been for years past, and it was then noticed in *The Daily Telegraph* that simultaneously a magnetic storm had raged over a large part of the Northern Hemisphere. Almost the only doubt that was felt as to the real character of the Polar Lights arose from the fact that Sir George Nares and his companions, wintering in the Arctic seas, and seeing many of these displays, came to the conclusion that they were "in no way connected with electrical or magnetic disturbances." But this impression can easily be accounted for by a curious fact, which Sir George Nares and his fellow-voyagers brought to light—namely, that the ice in those high latitudes, owing to excessive cold, possesses such exceedingly low conductivity as to approach almost to the character of glass. Hence the earth-currents would be deep beneath the ice. Strangely enough, at Greenwich Observatory, while the magnetic instruments are strongly agitated, the surrounding air shows no sign of electrical disturbance.

Professor Lemström has put the question to the test of experiment and received a decisive answer. At a point in North Finland, just within the Arctic circle, the professor constructed a network of wire on two conical mountains, which were respectively about 2,600 feet and 3,600 feet high. Hills of this shape were chosen because, as is well-known, electricity gathers most readily about sharp eminences. If mankind possessed an electro-static sense, and could perceive electricity as they can light, then we should see this now mysterious agency everywhere diffused in the world, and from all the edges, corners, and sharp points of rocks and hills, and church spires, and even the tips of the leaves of plants and trees, we should observe unceasingly at work day and night electric streamers keeping up the balance of Nature. Nothing in the visible universe is more grand or more varied as scenery than in all probability would be the aspect of the universe which such a sense would afford. It is now known beyond question that every species of motion, every change of temperature, every mode of friction, however slight, between any two dis-similar substances—though they be mere atoms in size—the daily course of the sun round the earth, the tidal strain which the moon exerts on the sea and on the solid crust of the globe, as well as every chemical combination, produces or is accompanied by electrical disturbance. The professor knew, therefore, that to and from these hill-tops electricity was darting; by experiment he determined to hasten the process and to render it visible. Copper wire being an admirable conductor, he connected the summits of the hills with the earth at their base by a network of this material, and the result was, as stated

in our telegrams, that instantly an arch of the aurora was formed overhead rising, it was estimated, to some 360 feet above the mountain top. This was a considerable distance at which to produce an artificial arch of light; but we have to remember that it is produced naturally hundreds of days every year in the same latitudes, near to the earth's magnetic pole, and the professor merely educed the radiant bow by giving assistance to natural forces. It was an echo to the positive currents of his wires. As the globe is a huge bar magnet, it is reasonable to expect powerful electro-magnetic effects near its poles, and as a matter of fact they are never wanting.

Two characteristics were noteworthy in this result. In the first place, the currents detected in the wires were what is known as positive. M. Planté some years ago showed how to produce something very like the aurora in the laboratory without using an exhausted vessel, but by merely causing the positive and negative wires of his battery to approach gradually a vessel charged with salt water—the sides of the jar being also moistened with the liquid. It was found that he could in this way produce arcs and wreaths, and sinuous lines of light strikingly like the Aurora Polaris; but, curiously enough, only at the positive end. It is significant that it was positive currents which rewarded the Helsingfors professor for his ingenious labours. A second feature was that the spectroscope showed the peculiar lines of the aurora. The spectrum of the aurora is a greenish-yellow line, and if this was recognised as stated there could be little doubt as to the genuineness of the phenomenon. The display lasted only a short time, because doubtless the electric pressure or tension was soon equalised, and, besides, the ice gathered so rapidly on the wires as to render them useless, and even to break them by its weight. As far as it went, however, the experiment appears eminently successful. It affords another illustration, like Wells's examination of the theory of Dew, and some of the elder Herschel's and most of Faraday's researches, how much may be accomplished by the simplest methods rightly directed.

There is still much to be done in the investigation of atmospheric electricity. Those mysterious fireballs known among the Portuguese as "Corpos Santos," and among English sailors as "Composants," are still unexplained; and even the origin of the electricity of a common thunderstorm can scarcely be said to be fully accounted for. It is noticeable that Professor Lemström confirms a remark of Sir Edward Sabine, who spent so many years of his life in making magnetic observations. While at anchor near Skye, he noticed that the "cloud-cap on one of the highest hills was permanently luminous at night, and occasionally gave out flashes like those of the aurora." There can now be little doubt that it was a veritable aurora, though strictly local. Commenting on this and some similar facts, eighteen months ago, Professor Tait, of Edinburgh, said that what was wanted to determine the truth as to the electricity of the air was large-scale experiments, and he recommended that some young physicists, clad in a suit of plate armour for their personal protection should, in the spirit of ancient chivalry, take their stations on the Connemara hills, where striking phenomena are often visible, and with the weapons of modern science, tap the lightning of the clouds and the surcharged electricity of the earth. In the same way as M. Lemström caused an aurora, thunderstorms might be prevented. Reversing the method, a captive balloon could carry into the clouds from a mountain summit the copper wire that would discharge the flash safely to the earth. Fuller, in his "Church History," says: "Scarcely a great abbey exists in England which once at least was not burned down with lightning from heaven." But since abbeys and churches have been protected by lightning-conductors, they have not only not been burned down, but have helped to protect the property near them. Buildings like St. Paul's and the tall spires of village churches built on high grounds, probably discharge many a thundercloud harmlessly in the course of a year. Nor must it be supposed that researches like these of Professor Lemström are merely contributions to theory. It seems not improbable that the laws of electro magnetic disturbance, when fully investigated, will serve to explain climatic changes and irregularities, and there are already meteorologists who look to this quarter for

trustworthy forecasts of storms. A genuine addition to knowledge always brings practical advantages in its train.—*Daily Telegraph*, March 5th.

In *Nature*, for February 1st, we gave a brief account of the remarkable results obtained by Professor Lemström, with his network of wires arranged up the face of the mountain at his station at Sodam-Kylä, in North Finland. By this means he succeeded in procuring an appearance exactly similar to that of the aurora borealis. In connection with these experiments, Mr. G. A. Rowell, assistant in the Natural History Department at Oxford, has issued a circular calling attention to the suggestion made by him forty years ago in reference to similar experiments. "My views on the cause of auroræ," Mr. Rowell states, "are, that they result from electricity carried over with vapour by the superior trade winds, from tropical to polar regions, and its occasional accumulation in the latter to such a degree as to flash back to lower latitudes, through the atmosphere at a reduced density, but still within the regions at which vapour is flotable, although in a frozen condition. The directive properties of the magnetic needle I attribute to the return current of electricity from polar to tropical regions. The following is the concluding paragraph of the report on my paper on this subject:—'The author supports his opinion by general reference to the observations on the aurora, &c., in the appendix to Captain Franklin's 'Journey to the Polar Seas,' and concludes with proposing the experiments of raising electrical conductors to the height of the clouds in the *frigid regions during the frosts in winter*, which in his opinion would cause the aurora to be exhibited, and lead to important discoveries in the science of magnetism."—(*Report* of the British Association, 1840, Sections, 4 p.9.—*Nature*, March 8th, 1883.

THE METEOROLOGICAL SOCIETY.

AT the last monthly meeting of this Society, held on March 21st at the Institution of Civil Engineers, Mr. J. K. Laughton, F.R.G.S., President, in the chair, a paper was read by Dr. H. Cook, F.R.G.S., F.M.S., entitled "Notes on a March to the Hills of Beloochistan, in North-West India, in the months of May to August, 1859, with remarks on the Simoom, and on the Dust Storms." These months may be considered as the summer of the hill country of Beloochistan, though the natives expect the weather to change soon after the fall of rain, which takes place about the end of July and beginning of August. Compared with that of the plains, the climate is delightful. The actual heat is greater than in England, especially the intensity of the sun's rays, but the weather is less variable. Fruits and crops, as a rule, ripen earlier, and are not exposed to the vicissitudes of the English climate. The atmosphere is clear and pure, the air dry and bracing. Dr. Cook describes different kinds of dust storms, and considers that they are due to an excess of atmospheric electricity. With regard to the simoom, which occurs usually during the hot months of June and July, it is sudden in its attack, and is sometimes preceded by a cold current of air. It takes place by night as well as by day, its course being straight and defined, and it burns up and destroys the vitality of both animals and vegetables. It is attended by a well-marked sulphurous odour, and is described as being like the blast of a furnace; and the current of air in which it passes is evidently greatly heated. Dr. Cook believes it to

be a very concentrated form of ozone, generated in the atmosphere by some intensely-marked electrical condition. After the reading of this paper, the Fellows inspected the Exhibition of Meteorological Instruments for Travellers. In addition to the ordinary instruments designed for travellers—viz., barometers, thermometers, hypsometrical apparatus, compasses, artificial horizons, &c., some very interesting historical instruments used by celebrated travellers and explorers were exhibited, including those used by Dr. Livingstone in his last journey; by Commander Cameron, during his journey across Africa; by Sir J. C. Ross, in his Antarctic expedition; by Sir E. Sabine in his Arctic voyage, &c.

MEASUREMENT OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—During a peculiarly rough winter, which has furnished (1) the heaviest snowstorm (Dec. 4th to 8th) and (2) the greatest flood (Jan. 28th) ever known in this district, the measurement of snow has forced itself on my attention.

My advice is this. Have a board placed in the most sheltered spot you can find, where snow drifts in or out as little as possible. Invert on this the funnel of an 8-inch gauge, or an 8-inch metal ring, and weigh what you catch to a quarter of an ounce. Divide the number of ounces by 29 and you have the fall in inches.

Taking one-twelfth of the fall is (in my opinion) useless. Why, yesterday morning the snow was only 2 in. deep for a fall (caught in the gauge) of 0·36, whereas on Sunday morning the same depth gave only 0·06. Air nearly still in both cases.

But in a really bad storm you are fortunate if by any device you can get within a quarter of an inch of the truth.

F. W. STOW.

Aysgarth Vicarage, March 21st, 1883.

[A letter from Mr. Stow, like a speech from Sir Edmund Beckett, is sure to be worth reading, and almost equally sure to provoke somebody to pugnacity. We are very glad to have Mr. Stow's experience, and to find that it nearly agrees with the rules already laid down. Rule XV., Section 2, says, "Select a place where the snow has not drifted, invert the funnel, and turning it round lift and melt what is enclosed." This differs from Mr. Stow's proposal chiefly in the question of melting *versus* weighing. Each method has advantages and evils; we consider the refinement of $\frac{1}{4}$ oz. = 0·009 in. inconsistent with the last clause of Mr. Stow's letter, and cannot agree to advise that observers should trouble themselves, and increase the risk of a muddle in their calculations, by weighing more closely than to the nearest ounce. Of course, very many observers have only 5 inch funnels, and then they must divide by $11\frac{1}{2}$, not a comfortable divisor for those who have forgotten their school learning.

As regards the rule of one-twelfth, we reprint a letter and our comment* upon it, written nearly twenty years since :—

MEASUREMENT OF SNOW.

"Referring to *British Rainfall*, 1864, p. 5, you give as one of three methods of measuring snow : 'Measure the average depth of snow, and take a twelfth as the equivalent of water.' This differs so widely from the result of my own observation, that I should be very glad to see the results of any direct experiments given on your first page. On a recent occasion, 2in. of snow gave ·37in. of water—that is, about 1 to 5·4.

"W. F. HARRISON, Bartropps, Weybridge Heath.

["My friend's note raises the point very clearly, and I willingly admit the rule to be bad ; but as some observers will not take the trouble to melt the snow, the rule was added to secure uniformity, and the nearest possible approach to accuracy. Obviously, the ratio depends entirely on the density ; and the following experiments in different localities and winters, show that any ratio from one-thirty-fifth to one-fifth may be obtained. I see nothing in the following table to induce me to recommend more than one-twelfth."]

We need not take up space by reprinting the table, it confirms, and so do many which have been given in different volumes of *British Rainfall*, Mr. Stow's statement that the value of a fall of snow may vary, not only from $5\frac{1}{2}$ to 33, as in the cases quoted by Mr. Stow, but from 5 to 35. But we cannot admit that the rule of taking a twelfth is useless, because sometimes one ought to take a fifth and sometimes a thirty-fifth. Take the cases Mr. Stow quotes :—

2 inches = 0·36 ... 1-12th would be 0·17, error 0·19
2 inches = 0·06 ... 1–12th ,, ,, 0·17, error 0·11

No one, we believe, suggests taking 1-12th when any better plan is available, but we have not yet seen evidence to convince us that it is better for a record to be left incomplete, than for it to be completed by the insertion of the result obtained by the rough rule of 1-12th. Until that evidence is produced, we cannot agree with Mr. Stow that the rule is "useless."—ED.]

SCHEME FOR THE OBSERVATION OF THE UPPER CLOUDS.

IN a circular which has nearly the above title, the Rev. W. Clement Ley invites the attention of meteorologists to a system of cloud classification, which, together with instructions on the method of making and telegraphing observations of the higher clouds, he has submitted to his colleagues of the Committee on cirrus observations, nominated in August last by the International Meteorological Committee.

The scheme is itself an abstract of part of a large work on clouds, now nearly ready for publication. In that work the author follows the primary outlines of cloud classification proposed by Luke Howard, dividing the objects of observation into—1st, *Cirriforms*, 2nd, *Cumuliforms*, 3rd, *Stratiforms*, 4th, *Composites* ; while in the sub-division of

British Rainfall, 1865, Appendix p. 7.

these primary types he is induced, by reasons the cogency of which he hopes to demonstrate, to deviate from Howard's classification.

The Note before us is confined to the subject of the cirriforms. As regards these, Mr. Ley writes :—

"I have been, after many years devoted to the consideration of the subject, reluctantly compelled to give up the employment of the two terms, 'Cirro-stratus,' and 'Cirro-cumulus.' Their use has led to endless confusion. In point of structure, the clouds usually called 'Cirro-cumuli' belong essentially to the higher Stratiforms, consisting of nubecules separate, or partly coalescing, occupying a layer of atmosphere of very small vertical thickness, but of very great horizontal extent, and they are not formed in nature by those processes which are productive of clouds either of the cirrus or of the cumulus type. They are, in fact, neither in appearance nor in mode of physical formation, either compounds of cirrus with cumulus, or hybrids between cirrus and cumulus. Therefore, in practice, the use of the word 'cirro-cumulus,' has led to a large number of clouds of no great elevation being classified amongst the cirriforms; a result which was of little consequence when the laws regulating the upper currents of the atmosphere had received no examination, but which must prove absolutely fatal to a scheme based upon those laws, according to which new and most valuable results will be attained. The name 'cirro-stratus' is almost equally objectionable, and for similar reasons. I divide the Cirriforms as follows :—

I.—CIRRUS (Curl-cloud), Cir.
II.—CIRRO-FILUM (Gossamer-cloud,) Cir-fil.
III.—CIRRO-VELUM (Veil-cloud), Cir-vel.
A. var. MAMMATUM (Tubercled Veil-cloud), Cir-vel. Mam.
IV.—CIRRO-NEBULA, (Veil-haze), Cir-neb.
V.—CIRRO-GRANUM (Granular Curl-cloud), Cir-gr.
VI.—PSEUDO-CIRRUS PENDULUS (Brush-cloud), Ps-Pend.
VII.—PSEUDO-CIRRUS FRACTUS (Snow-rack) Ps-fr."

Descriptions of these clouds follow, and symbols are given for employment in written or printed weather reports. Six pages of the "Note" are then devoted to a lucid description of the method of observation and telegraphy which the writer advocates. As regards the results anticipated, Mr. Ley says :—

"It is difficult to estimate the advantages which would be derived from the possession of a staff of observers at outlying stations, who would communicate accurate telegraphic information of the forms of the upper clouds, and of the movements of the upper currents to the head-quarters of the different Meteorological Services. If the observers can be obtained, this scheme will in my own opinion, at once double the value of existing systems of storm-warnings. An isolated observer in the English Midlands is enabled, as I have proved year after year, by observations of the clouds of all classes, but principally, (*i.e.* in the most unsettled weather) by the study of the cirriforms; first, to post up the local weather of the next twenty-four hours, with almost invariable success, being defeated on an average in about eight days in the year. Secondly, to plot out on a map the general distribution of atmospheric pressure, and of weather existing over the whole of the British Isles at the time of his observations, with very considerable accuracy. Thirdly, to form a forecast of the dis-

tribution of atmospheric pressure, and of weather over the British Isles for the next twenty-four hours after the observation, which forecast shall be in a rather large majority of cases correct. Fourthly, to furnish information of coming storms in some instances before any instrumental indication can be telegraphed from the western coast of Ireland. I believe that the addition of a number of cloud observers, properly grouped as regards locality, would be a gain to the Meteorological Service of each country almost comparable to that which a chess player would receive by the augmentation of the number of his pawns."

With this paragraph we are inclined to agree, for we have always held that the reporting of mere readings of barometer, thermometer, &c., does not adequately convey to the Central Office the individualities (if we may so express it) of local weather. But it must not be overlooked that the whole paragraph hangs on six words—"*If the observers can be obtained.*" That is the real difficulty. Are there a dozen men in all Europe who would be as successful as Mr. Ley? Certainly not.

There are also minor difficulties. If Mr. Ley is going to have an equally minute sub-division of Cumuli, Strati, &c., the entire vocabulary will be somewhat alarming to beginners, for if each group is to have eight varieties, and nearly half of them with triple names, such as "Cirro-Velum Mammatum," the duties of a cloud observer will be no joke.

Then there is the grave inconvenience of disturbing an established nomenclature, against which is to be set the fact that with the development of our knowledge of the upper currents, corresponding developments of nomenclature may reasonably be expected, and if they are to be proposed, no man has a greater right to be heard than Mr. Ley.

We may, however, feel sure that the subject will, for some time to come, command considerable attention. Our readers will scarcely need referring to Prof. Poëy's works, *Comment on observe les Nuages*,* and *Les Courants atmosphériques d'après les Nuages au point de vue de la Prévision du temps*,† but we must also call attention to an excellent memoir by M. Weilbach on the forms of cloud in Northern Europe, which has just been published in one of the volumes of the *Annales du Bureau Central Météorologique de France*, and to the extremely good synopsis of the history of cloud nomenclature and classification which M. Weilbach has there given.

OCTOBER, 1882, IN EASTERN RUSSIA.—At Katerinberg (lat. 57° N. Lon., 61° E.) on the east side of the Ural Mountains, the mean temperature for October is 0°·9 C. (33°·6 F.), and the lowest value since 1836 was −3°·2 C. (26°·2 F.) in 1856. For October 1882 the mean was −3°·9 C. (25°·0 F.), being 8°·6 F. below the average. The maximum on 19 days was below freezing point, and minima occurred of −19°·C. (−2°·6 F.) and −17°·9 C. (−0°·2 F.). Katerinberg is not a very high station, its altitude being only 886 feet above sea level.

* See *Met. Mag.* vol. xv. (1880) p. 2. † See *Met. Mag.* vol. xvii. (1882) p. 99.

BALL LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—Referring to the recent review in the *Times* of Mr. Scott's "Elementary Meteorology," in which "globular lightning" is said to be so rare that some physicists "deny the possibility of its existence," I beg to append an authentic record of a case. Major J. R. Molineux, of Brook House, Compton, near Guildford, in a letter to me this day quotes from his journal under date July 12th, 1868:—"Heavy rain and storm during the day. Evening, about 8, the storm renewed; forked flashes on dark clouds, very grand, particularly one from a centre of fire. About 9, when I was in the library with the shutters closed, seated by a lamp, intent on a book, the storm having apparently receded, a gleam of electric light, the brightest I ever saw, seemed to pour into the room through the chinks, instantly succeeded by a crash of thunder. Cry from my wife in the room above. She thought she had been struck. She saw a ball of fire fall, apparently close to the window. It was the size of my sponge bath, about 3 ft. in diameter. My son, passing under a skylight, saw the fall of lightning. He, too, thought it had struck him. The rain then fell in torrents. The next morning I examined the garden, and found the only damage done was that a hole or jagged trench, about 8 in. deep, and 8 or 10 ft. long, had been made in the gravel, near the kitchen chimney.

I remember the lightning, when the ball fell, was so bright as to make the room seem dark after its retreat, although I had a good reading lamp by my side; and it seemed to blaze and quiver on the wires of two large bookcases opposite me. An old labouring man, named Stovold, told me afterwards he was passing by the common near my house at the time, and that when the lightning fell, he thought he was 'set afire by the blaze.' My wife, I may add, had never even heard of such a form of lightning before."

The above account may certainly be depended upon, and was given to me in conversation previously.

I am, Sir, your obedient Servant,

J. RAND CAPRON, F.M.S.

[Mr. Rand Capron does not seem to have quite realized the distinguishing and puzzling feature of "Ball Lightning"; at any rate the above case is by no means so difficult to explain as the very good illustrations quoted by Mr. Scott. There is nothing in the above account to indicate slowness of motion except that the flash produced on the retina of two persons the impression of a ball of fire, but probably half a second would do that. Mr. Scott's definition is perfect. He says, "It manifests itself as a luminous sphere, varying in diameter from a few inches to even two or three feet. It moves very slowly, and remains visible for several seconds, or even minutes, generally at last exploding with great violence."

The *Report of the Lightning Rod Conference** dealt with lightning rods rather than with lightning, but several references to ball lightning

* Spon, Charing Cross, 1882.

will be found in it. Among others the following abstract of a very interesting French memoir :—"Le Coup de Foudre de l'Ile du Rhin pres de Strasbourg," par M. F. Hugueny :—

A very full account of an accident by ball lightning. The facts are set out as clearly as possible, the authority is given for every statement, and there are most carefully engraved plans and engravings of all the necessary details. It does not bear upon the question of lightning conductors except in that it shows that a discharge of globular lightning traversed a horizontal distance of 919 yards, passed in front, but below the top, of a building which had three good conductors upon it, and struck a chestnut tree, which was by no means the highest tree in the locality.

We make one other quotation from this report—viz., on the very high authority of Professor Tait :—

"Fireball or globe lightning undoubtedly exists, and is probably due to a species of natural Leyden jar, very highly charged, which no lightning rod can destroy, except, perhaps, a close network of stout copper wires."

A very careful paper upon the subject by Cromwell F. Varley, F.R.S., will be found in the *Phil. Trans.* 1871, and that electrician has actually produced the effect experimentally, of course, upon a small scale.

We may also refer those interested in the subject to the paper upon "Lightning and Lightning Conductors" read by W. H. Preece, C.E., F.R.S., before the Soc. Telegraph Engineers in 1872, and reported, together with the discussion, in Vol. I. of their Journal.

EXTRAORDINARY WAVE IN THE CHANNEL.

The Weymouth and Channel Islands Steam Packet Company's mail steamer *Aquila* left Weymouth at midnight on Friday for Guernsey and Jersey. On her passage across Channel, the weather was calm and clear, and the sea was smooth. When about one hour out, 1 a.m., 31st March, 1883, the steamer was struck violently by mountainous seas, which sent her on her beam ends and swept her decks from stem to stern. The water immediately flooded the cabins and engine room, entering through the skylights, the thick glass of which was smashed. As the decks became clear of water, the bulwarks were found to be broken in several places, one of the paddle boxes was considerably damaged, the iron rail on the bridge was completely twisted, the pump was broken and rendered useless, the skylight of the ladies' cabin was completely gone, and the saloon skylight was smashed to atoms. The cabins were baled out with buckets, while tarpaulins were placed over the skylights for protection. Five minutes after the waves had struck the steamer, the sea became perfectly calm. Several of the crew were knocked about, but no one was seriously injured.

[This paragraph embodies the substance of the reports published in the English and French newspapers, generally under the heading of "Tidal Wave in the Channel." We think that the phenomenon was more probably due to an earthquake wave, but enquiries are in progress, and if any important facts are elicited they will be given next month.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOV., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	61·8	5	25·4	18	49·4	38·2	37·5	78	91·8	23·3	2·57	18	5·9
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	81·5	28*	69·2	12	80·0	71·5	64·4	69	...	...	·74	12	5·4
Calcutta	86·6	2	61·2	17†	81·2	66·9	65·1	76	150·5	47·1	1·61	2	3·5
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	90·3	16‡	67·2	6	85·1	70·9	67·6	70	144·2	57·3	·03	2	2·1
Ceylon	88·8	19	72·3	23	86·2	74·7	71·5	74	154·0	67·3	11·58	10	6·1
Melbourne	96·6	9	42·6	1§	72·1	51·6	49·1	67	154·0	35·7	3·31	7	5·4
Adelaide	101·3	8	43·7	1	82·7	56·1	50·6	51	161·2	35·3	·90	8	4·1
Wellington	79·0	24	41·9	12	63·5	48·5	...	...	139·0	40·0	4·33	11	...
Auckland	76·5	23	42·1	9	66·5	51·9	50·3	73	131·5	38·2	1·95	15	6·9
Falkland Isles	59·3	19	35·2	1	53·7	39·7	41·7	77	126·0	30·0	2·75	18	7·2
Jamaica	89·3	2	65·4	20	86·4	69 9	68·5	76	...	58·5	1·29	4	4·3
Barbados	84·0	3	68·0	13	80·0	73·0	73·4	85	146·0	66·0	8·93	26	6·0
Toronto	64·2	11	7·2	28	41·6	29·4	31·7	76	124·0	5·0	2·15	16	7·4
New Brunswick, S. John	62·0	1	18·0	29‖	39·8	28·7	29·9	80	...	...	2·30	12	6·5
Cape Breton, Sydney	60·0	1	23·9	8	42·4	32·2	32·6	82	...	...	5·58	15	7·0
Manitoba, Winnipeg	40·9	6	–11·1	24	27·7	11·9	19·6	79	99·0	...	0·91	8	6·6
British Columbia	...	...	...	...	...	...	...	...	...	...	...	...	...

* And 30. † And 19, 21. ‡ And 20. § And 4. ‖ And 30.

REMARKS, NOVEMBER, 1882.

Mauritius.—Rainfall 1·61 in. below average; mean temp. 0°·2 above it; mean pressure, 30·064 in.; mean hourly velocity of wind 10·5 miles, extremes 25·9 miles and 2·2 miles; prevailing direction E.S.E. to E.N.E. C. MELDRUM, F.R.S.

Melbourne.—Mean pressure slightly, and mean temp. 1°·2 above the average; humidity about the average, amount of cloud below it; rainfall 1·46 in. above it; prevailing direction of wind S., strong breezes occurring on six days; heavy dew on three days; L on three days, T and L on 22nd, with H; Aurora Australis on 17th and 20th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (29·985 in). ·100 in. above the average; mean temp. (69°·4) 2°·7 above it. Rainfall slightly below the average. Heavy R and terrific TSS traversed that portion of the continent S. of lat. 27° apparently moving in a S.E. direction; the north pastoral districts recording the heaviest downpours, nearly 4 inches at many places, and with the exception the of S.E. portion of this colony, the fall was in excess of previous years. In Central Australia it reached the mean, but towards the N. coast, it was very heavy, some stations recording over 7 and 8 inches. C. TODD.

Wellington.—First three days fine, then unsettled till 9th, with heavy R and T on 8th; the remainder of the month was generally fine, with the exception of two short wet periods, 14th to 16th, and 25th to 27th. Prevailing winds N.W. and S.E. generally moderate, but strong on 7th; earthquakes on 18th and 25th; Auroræ on 17th and 20th. R. B. GORE.

Auckland.—Weather mostly cloudy, especially in the first half of the month. Rainfall small, and in slight showers, except a heavy fall on 4th; wind strong, chiefly S.W.; pressure high, mean 30·189 in. Fine aurora on 21st, with rapid fall of bar. ensuing. E. B. DICKSON.

Falkland Isles.—Heavy H showers on 24th and 25th. F. E. COBB.

BARBADOS.—Mean temp. 76° 3, the same as the average; average velocity of wind 7·8 miles per hour, extremes 15·9 miles and 1·5 miles; rainfall 9 per cent. above the average; evaporation the same as the average; nine days were overcast; T SS on 3rd, 11th, and 12th. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,

MARCH, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·35	XI.	Llanfrechfa Grange	·94
,,	Margate, Birchington...	1·04	,,	Llandovery	2·18
,,	Littlehampton	·51	,,	Solva	·91
,,	St. Leonards	1·20	,,	Castle Malgwyn	2·97
,,	Hailsham	1·09	,,	Rhayader, Nantgwillt..	2·83
,,	I. of W., St. Lawrence.	·78	,,	Carno, Tybritle	1·51
,,	Alton, Ashdell.....	1·21	,,	Corwen, Rhug	2·44
III.	Great Missenden.....	1·06	,,	Port Madoc	2·92
,,	Winslow, Addington ...	1·06	,,	I. of Man, Douglas	1·32
,,	Oxford, Magdalen Col...	·99	XII.	Carsphairn	3·59
,,	Northampton	1·15	,,	Melrose, Abbey Gate...	2·68
,,	Cambridge, Beech Ho...	·79	XIII.	N. Esk Res. [Penicuick]	1·95
IV.	Southend	·65	XIV.	Ayr, Cassillis House ..	1·56
,,	Harlow, Sheering	1·00	,,	Glasgow, Queen's Park.	1·25
,,	Diss	1·93	XV.	Islay, Gruinart School..	1·88
,,	Swaffham	1·72	XVI.	St.Andrews,NewtonBk	1·29
,,	Hindringham	1·76	,,	Aberfeldy H.R.S.	2·98
V.	Salisbury, Alderbury...	1·12	,,	Dalnaspidal	3·23
,,	Warminster	1·70	XVII.	Keith H.R.S.	2·28
,,	Calne, Compton Bassett	1·12	XVIII.	Forres H.R.S.	1·85
,,	Beaminster Vicarage ...	1·69	,,	Strome Ferry H.R.S....	4·18
,,	Ashburton, Holne Vic..	2·94	,,	Lochbroom	2·33
,,	Torrington, Langtree W.	1·06	,,	Tain, Springfield.....	1·41
,,	Lynmouth, Glenthorne.	1·36	,,	Loch Shiel, Glenaladale	4·45
,,	Probus, Lamellyn	2·26	XIX.	Lairg H.R.S.	2·44
,,	Taunton, Fullands	·53	,,	Forsinard H.R.S.	3·84
VI.	Bristol, Clifton	·95	,,	Watten H.R.S.	2·20
,,	Ross	·92	XX.	Fermoy, Glenville	1·96
,,	Wem, Sansaw Hall.....	...	,,	Tralee, Castlemorris ...	1·64
,,	Cheadle, The Heath Ho.	1·19	,,	Tipperary, Henry Street	1·14
,,	Worcester, Diglis Lock	1·05	,,	Newcastle West	·82
,,	Coventry, Coundon	1·14	,,	Kilrush	...
VII.	Melton, Coston	1·20	,,	Corofin	1·18
,,	Ketton Hall [Stamford]	·95	XXI.	Carlow, Browne's Hill..	1·70
,,	Horncastle, Bucknall ...	1·29	,,	Navan, Balrath	1·03
,,	Mansfield, Market Place	1·51	,,	Athlone, Twyford	·92
VIII.	Macclesfield, The Park.	·91	XXII.	Mullingar, Belvedere ...	1·01
,,	Walton-on-the-Hill.....	1·09	,,	Clifden, Kylemore	3·59
,,	Lancaster, South Road.	1·04	,,	Crossmolina, Enniscoe..	2·37
,,	Broughton-in-Furness ..	...	XXIII.	Carrick-on-Shannon ...	·36
IX.	Wakefield, Stanley Vic.	1·09	,,	Dowra	...
,,	Ripon, Mickley	1·91	,,	Rockcorry.....	1·12
,,	Scarborough.....	1·78	,,	Warrenpoint	2·06
,,	EastLayton[Darlington]	...	,,	Newtownards	1·27
,,	Middleton, Mickleton ..	2·19	,,	Belfast, New Barnsley..	1·56
X.	Haltwhistle, Unthank..	1·17	,,	Bushmills	1·33
,,	Shap, Copy Hill	3·67	,,	Buncrana	2·54

MARCH, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·86	— ·75	·29	19	11	57·0	31	22·4	24	21	25
II.		Maidstone (Hunton Court)...	1·35	— ·23	·27	18	14	...	...	...	...	...	...
,,		Strathfield Turgiss	·73	— ·67	·36	19	6	56·2	5	13·8	24	25	27
III.		Hitchin	·75	— ·73	·28	19	13	51·0	30*a*	17·0	23	27	...
,,		Banbury	1·24	— ·36	·51	19	15	54·0	30	18·0	10	27	...
IV.		Bury St. Edmunds (Culford)	1·88	+ ·32	·56	7	15	53·0	31	15·0	9	26	...
,,		Norwich (Cossey)	1·95	+ ·26	·23	19	18	54·0	31	17·0	10	24	24
V.		Bridport	1·12	...	·40	29	8	...	...	...	...	...	...
,,		Barnstaple.....	·98	— 1·51	·18	26	10	56·0	6	23·0	16	...	...
,,		Bodmin	1·88	— 1·28	·57	29	15	53·0	5	21·0	24	15	27
VI.		Cirencester	2·11	+ ·04	·85	26	7	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	1·14	— 1·02	·41	19	13	52·0	30*a*	19·0	9, 10	25	28
,,		Tenbury (Orleton)	1·38	— ·49	·47	19	18	57·0	5	16·3	10	24	28
VII.		Leicester	·95	...	·36	19	13	55·0	30*a*	16·0	10	24	25
,,		Boston	1·37	+ ·08	·33	19	12	55·0	5	18·0	10	22	...
,,		Grimsby (Killingholme).....	1·56	— ·10	·32	19	18	53·0	30	21·0	10	20	...
,,		Hesley Hall [Tickhill].....	1·16	...	·36	19	11	58·0	4	7·0	9	25	...
VIII.		Manchester (Ardwick).....	1·19	— 1·26	·42	20	10	51·0	30	21·0	10	21	...
IX.		Wetherby (Ribston Hall) ...	1·64	— ·49	·54	8	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·40	— 2·36	·82	29	11	58·0	4	18·0	9	...	...
X.		North Shields	2·14	+ ·69	·43	7	19	54·8	5	22·8	10*b*	25	26
,,		Borrowdale (Seathwaite).....	6·77	— 3·12	3·95	29	9	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	·63	— 2·06	·16	25	9	...	...	...	...	...	...
,,		Haverfordwest	1·94	— 1·25	·98	29	14	52·0	1	18·4	9	20	27
,,		Plinlimmon (Cwmsymlog) ...	1·95	...	·44	29	11	...	...	...	..	...	...
,,		Llandudno.....	1·73	— ·15	·45	29	13	52·8	3	26·0	24	12	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·14	— ·64	1·36	29	6	51·8	2	23·2	17	23	...
,,		Hawick	1·91	— ·05	·59	29	13	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	2·74	— ·40	1·30	29	6	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	...	...	...	...	...	...	...	20·0	27	24	...
,,		Appin (Airds)	1·40	...	...	...	...	...	...	...	...	...	.
,,		Mull (Quinish).....	2·10	...	1·03	30	16	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·20	— ·92	·50	20	7	...	...	...	...	...	...
,,		Arbroath	1·97	+ ·34	·46	29	16	52·0	5	24·0	15	20	...
XVII.		Braemar	3·26	+ 1·07	1·00	29	21	61·0	2	6·0	23	29	31
,,		Aberdeen	3·84	...	·53	25	25	55·0	2	23·0	26	20	...
XVIII		Skye (Sligachan)	7·48	...	5·50	30	21	...	...	...	...	...	...
,,		Culloden	1·52	— ·23	...	...	...	57·0	1	23·0	23	18	29
XIX.		Dunrobin	2·12	...	·30	17	19	58·5	1	21·5	23	19	...
,,		Orkney (Sandwick).....	2·56	— ·08	·64	18	25	47·0	2,5	26·8	6	18	24
XX.	IRELAND.	Cork (Blackrock)	2·24	— ·52	1·56	29	13	58·0	1	22·0	23	19	...
,,		Dromore Castle	2·52	...	·70	29	14	65·0	1	25·0	23	12	...
,,		Waterford (Brook Lodge) ...	1·67	...	·95	29	13	55·0	1,5	23·0	24	16	...
,,		Killaloe	·89	...	·28	29	13	60·0	4	20·0	24	15	...
XXI.		Portarlington	·98	— 1·18	·35	29	16	51·5	5	23·0	23	24	...
,,		Dublin (FitzWilliam Square)	1·06	— ·67	·46	20	12	51·5	1	25·4	24	16	19
XXII.		Ballinasloe	·92	— 1·46	·47	29	12	49·0	1	24·0	9	23	...
XIII.		Waringstown	1·46	— ·60	·73	29	10	55·0	1,4	20·0	14*c*	23	23
,,		Londonderry (Creggan Res.).	2·85	...	·68	29	20	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·97	— ·12	·53	29	20	50·0	1,2	20·0	26	25	...

+ Shows that the fall was above the average; — that it was below it.

a And 31. *b* And 17, 28. *c* And 26.

METEOROLOGICAL NOTES ON MARCH.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—March was fine but cold, with searching E. winds and severe frosts at night, which, however, did not penetrate much below the surface. The land is now seeded in a far more efficient way than would have been possible without the frost. Peacock butterfly seen on the 1st, thrushes nest with three eggs on 7th, wasp on 30th. Narcissus in flower on 10th; coltsfoot on 16th.

HITCHIN.—Mean temp. of the month unprecedentedly low (32°·9) 6°·6 below the average of 30 years, and ten degrees below that of March, 1882.

BANBURY.—A very cold month, but favourable to farmers; mean temp. 35°·2, 5° below the average; high wind on six days; S on twelve days. Parhelia seen on 8th.

CULFORD.—A thorough winter month, very distressing to vegetation. S. on seven days.

COSSEY.—A very cold month; more or less S about under the fences, from 6th to 30th. Meadows quite brown, not a shade of green on them, and many fields of wheat scarcely visible. Max. temp. on 22nd, only 33°.

BODMIN.—A very remarkable cold March; mean temp. 37°·7, 5°·4 below that January. Min. temp. on grass 12° on 24th. S on five days. H on three days.

CIRENCESTER.—A dry cold month, the first month with rainfall below the average for a long time.

WOOLSTASTON.—A month of unprecedented severity, the mean temp. being only 35°·0, and the mean min. 28°·3. S on eight days; strong gale on 28th.

ORLETON, TENBURY.—The coldest March since 1845, only three nights without frost. Mean temp. more than 5° below the average of 20 years, and nearly 1° below that of March, 1867. The temp. of the first six days was about the average, but it then became very cold, with severe frosts, which continued till the end of the month. There were frequent light falls of S, and very strong and intensely cold winds between the 19th and 25th. Rainfall much below the average, and less cloud than usual The effects of the drying wind upon the land was very favourable, but fruit trees and all vegetation were checked. S on 14 days.

LEICESTER.—A very cold month; four inches of S on the ground on 8th.

BOSTON.—Nearly the whole of the precipitation was in the form of S, which fell on ten days The temp. was exceedingly low, and the weather bitterly cold; on the 10th, the temp. fell to 18°0, the lowest recorded in March since 1872. On the 24th, the temp. suddenly rose in the middle of the day from freezing, to 46°, and then as suddenly fell again, the night temp. being 23°, this warm wave lasted about two or three hours. On the 11th, the tide rose higher than it had done since 1820, to 17 ft. 7 in. above ordinance datum, or 4 ft. 3 in. above an ordinary spring-tide, causing great damage to the sea banks, and inundating the lower part of the town; this extraordinary height was due to the very strong gales which had been blowing for several days from N.E. and N.W., coming at the same time as the spring equinoctial tides. The frosts and drying winds, although putting everything very backward, wonderfully improved the condition of the land, and made it in good order for working the spring sowing.

GRIMSBY, KILLINGHOLME.—A month of unusual cold and strong gales, but the frost greatly benefited the heavy lands. Terrible loss of life and property in the fishing fleet, from the Humber ports. Gale on the 6th; remarkably high tide in the Humber on 10th. S on 11 days.

HESLEY HALL, TICKHILL.—Mean temp. of the month 35°·4.

NORTH SHIELDS.—S on 17 days.

WALES.

HAVERFORDWEST.—The month commenced with a falling temp., the cold gradually increasing in severity, very low day and night temperatures were registered, and large sheets of water were frozen over, and the banks of the river presented quite an Arctic appearance on several mornings, fields of ice forming after the recession of the tide. S fell in considerable quantities on eight days, and the high lands were white for some days. The exceptional temperature of 18°·4, 19°·0, 22°·0 and 25°·0 were registered on different days, being the lowest recorded in March, since 1866; and on grass the min. fell to 10°·0 on the 9th. Arable lands in splendid condition after the frost. Mean temp. of the month 37°·4, being the lowest in March during 36 years, wind mostly from E., blowing very hard at times.

LLANDUDNO.—Notwithstanding some fine bright days, particularly at the beginning and near the end of the month, the weather generally was cold and stormy, with frequent showers of H and S, which, however, did not lie except on the distant hills. Mean temp. no less than 5°·7 below the average, but the frost was not of any great severity, except on one night. There was an unusual prevalence of E. and N. winds, which were very strong from the 6th to 8th inclusive. Duration of bright sunshine 102·4 hours.

SCOTLAND.

CARGEN.—The coldest March since observations were commenced 24 years ago; mean temp. 36°·3, 5°·0 below the average; the next coldest March was in 1867, when the mean temp. was 37°·2. N. and E. winds prevailed on 27 days; mean pressure ·175 in. above the average; sunshine about the average. Occasional S showers.

HAWICK.—The most frosty and snowy March ever remembered; out-door work at a standstill from 7th to 29th. S on 10 days.

ABERDEEN.—Cold and stormy throughout; temp. low, and rainfall greatly in excess of the average. Aurora seen on three nights; T and L on the night of 17th; hard gale on 29th. S on 19 days.

CULLODEN.—A cold month; heavy snowfall during the last week. Farm-work considerably in arrear, owing to continued night frosts.

SLIGACHAN.—The first five days were mild, but the remainder of the month was very cold, although frequently bright. Prevailing winds N. and N.E. frequently strong. During the 29th, and early morning of the 30th, a severe storm of wind and R occurred, 5·50 inches falling in 24 hours. Frost on 13 nights; S on 19 days.

SANDWICK.—March was unusually cold and stormy, with a rainfall below the average, being mostly in the form of S. The ground was white with S on 14 days, but generally it was thawed by the sun. Snow rollers were formed on 18th. There were gales of fifty miles an hour on 18th, 24th, 30th, and of fifty to sixty miles on 5th, 6th, and 29th. Aurora on 27th.

DROMORE CASTLE.—The early days of the month were fine and mild, succeeded by cold winds, hailstorms, and sometimes S, which stopped vegetation. The month nevertheless was, on the whole, favourable for tillage operations.

IRELAND.

WATERFORD, BROOK LODGE.—The month generally was dry, but there were slight showers of S on several days; prevailing winds N.E. to E.; rainfall about ·75 in. below average.

KILLALOE.—A bright and very cold month, frequent sharp frosts, and mean temp. unusually low (41°·5). In a record of 37 years March, 1883, occupies third place for lowest rainfall, the first and second places being taken by March 1850, ·54 in., March 1856, ·71 in.; S on 11 days.

DUBLIN, FITZWILLIAM SQUARE.—An intensely cold and dry month, with constant polar winds and frequent showers of H, sleet and S; mean temp. (38°·2) slightly below that of the memorably inclement March of 1867, and

nearly 5° below the average of 18 years. It was also 5° below the mean of January and February, 1883. T on 15th, L on 27th, air foggy on 4 days, solar halo seen on 28th, S or sleet fell on 10 days, and H on 12 days.

BALLINASLOE.—A very harsh and cold month, strong N. to E. wind prevailing; vegetation utterly checked; S on 6 days.

WARINGSTOWN.—A most favourable month for preparing land for spring crops, the drying wind, slight falls of S, and the effects of the sharp frosts on ploughed land, combined in a most unusual way to pulverise and mellow even the stiffest soil. S on 6 days.

CREGGAN RES.—The month was stormy and very cold. S on 10 days.

EDENFEL.—With the exception of the first few days the weather of the month was extremely inclement. Farm labour very backward.

FOG GAUGES.

WE have received from Mr. Ormerod of Teignmonth a letter and some photographs bearing upon the above subject. As we are this month very short of space we are obliged to give merely the following abstract of the letter. Mr. Ormerod approves of the general plan and dimensions suggested in our last number, but has substituted a strip of zinc for the board, as he thinks that the metal will stand the weather better; he has put the numbers by the side of the lines instead of above them, as he considers that it makes it more compact. This alteration we do not admire: when a figure is *between* two stripes there is always liability to apply it to the wrong one, and unless the figures are very large they will not be readable in a dense fog. Lastly, he has mounted it on the top of his Stevenson screen, to which it fits extremely well. Mr. Ormerod considers that the name of Fog Gauge will have to be adopted, as the only other that he can think of is Zophoscope from Ζόφος, darkness or gloom; but we do not want to measure darkness, but opaqueness.

ERRATA IN METEOROLOGICAL MAGAZINE, 1882.

ON comparing the returns supplied to us monthly for publication, with those received for the whole year, many differences have been detected, and correspondence is in every instance opened with the observer. The result has been much worse than usual, for fourteen observers state that their monthly reports have been wrong. Hence the following corrections:—

REGULAR TABLE.

Ribstone, September, should be	1·45	Haverfordwest, Feb., should be	4·49
Haverfordwest, Jan. ,, ,,	6·81	Waringstown, Aug. ,, ,,	3·51

SUPPLEMENTARY TABLE.

Abinger, November, should be	3·07	Ripon, December, should be	3·06
Alton, February, ,, ,,	2·59	Dowra, February, ,, ,,	1·91
Taunton, January, ,, ,,	1·51	,, March, ,, ,,	4·09
,, March, ,, ,,	1·08	,, April, ,, ,,	2·27
Sansaw, October, ,, ,,	4·32	Rockcorry, March, ,, ,,	3·80
Cheadle, May, ,, ,,	2·82	Warrenpoint, April ,, ,,	5·38
Coundon, September ,, ,,	2·85	Buncrana, Sept. ,, ,,	5·33

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCVIII.] MAY, 1883. [PRICE FOURPENCE, or 5s. per ann post free.

THE TEMPERATURE OF THE THAMES.

FORTY years ago, at the suggestion of the medical officers in the department of the Registrar-General, arrangements were first made for obtaining a daily record of the temperature of the river Thames.

In those days (as pointed out by Luke Howard) the pattern of thermometer invented by Six had been so far departed from, with a view to cheapness and commercial objects, that it had passed into disrepute, and therefore the thermometers supplied were on Rutherford's pattern, which was perfect for recording the lowest temperatures, but extremely bad for registering the highest points reached. These thermometers were enclosed in an upright wooden trunk attached to the side of the Dreadnought Hospital ship, which was moored in the river a little above Greenwich. This wooden trunk was closed at the bottom, and extended from a foot or two above, to 3 ft. below, the ship's water line, and that portion of the trunk which was below the water line, and also the bottom board, was pierced to ensure circulation. The thermometers were suspended 2 ft. below the water line. These observations commenced in May, 1844; the only important change for the following 26 years was the substitution of a Negretti's patent maximum for the defective Rutherford thermometer.

In April, 1870, these Dreadnought observations ceased, and there was no record until 1871—in fact, the changes since then have been somewhat numerous, and must be dismissed briefly. The general system of mounting the instruments and of observing has been adopted throughout. From January, 1871, to May, 1874, the observations were made from the police ship "Scorpion," moored between Greenwich and Blackwall. In May, 1874, they were transferred to the "Royalist," moored in the same place; but in October, 1879, the "Royalist" was run into, and after repair she was placed on the river bank, where observations were impossible, and all records ceased.

The late Astronomer Royal, Sir G. B. Airy, K.C.B., F.R.S., has recently published in the *Proceedings of the Royal Society* an analysis of the whole of the observations. From it, and from the weekly

returns published by the Registrar-General, the broad features of Thames temperature seem to be as follows :—

On the average of 33 years the temperature of the river (51°·7) is higher than that of the air at the Royal Observatory (50°·2) by 1½°. During the seven months, May to November, this difference averages 2°·0 ; and during the winter, December to April, only 0°·7.

On the average of the 33 years, July gives the highest monthly mean river temperature, 65°·7, and January the lowest, 39°·4.

If, however, we look to individual months, we have some very much wider extremes : for instance, the average for June, 1846 (a very hot month), was 73°·1. In 1859 (when it will be remembered there were loud complaints of the state of the river) the temperatures were remarkably high ; in every month, except April, May, and December, they were above the average, and five of the months were hotter than any corresponding month during 33 years. The coldest month seems to have been January, 1850, of which the mean temperature of the river is said to have been only 33°·0.

The highest temperature recorded seems to be 77°·0 on June 21st, 1846, but that was in the days of Rutherford's maximum, and the heat was too much for it, as on the next day it had to be sent away for repair. The next highest reading, and probably a true one, was on July 20th, 1859, 75°·4.

As regards lowest temperatures, it seems difficult to be certain. Pure water freezes at a point very slightly below 32°. Sea water freezes at about 27°·7. It is, perhaps, an open question at what temperature ordinary Thames water freezes, but in 1850 temperatures below 32° are reported daily from January 1st to 24th, and there is an entry of 29°·4 on January 15th.

The fact that no observations had been made for upwards of three years having come to the knowledge of the Committee of the Corporation, which acts as Port Sanitary authority for London, instructions were given to Mr G. J. Symons, F.R.S., to sketch a scheme of observations to be organized and continued at their expense.

Some years back the Corporation purchased the Dockyard at Deptford, and converted parts of it into a Foreign Cattle Market ; for the convenient unloading of vessels three jetties are run out (each about 200 feet) into the river. The extremities of these jetties have a depth of eleven feet of water even at dead low water ; there is, therefore, at all times, more than sufficient volume of water entirely to annul any warming or cooling effect due to shallow shore water. The position is very near to (in sight of) that occupied for more than a quarter of a century by the Dreadnought. Lastly, there is resident on the spot Mr. Philcox, the Clerk of the Market, and several officers have been trained as observers, so that continuity and regularity is assured, and for these reasons this locality has been selected.

For observations of river or sea temperature it is imperative that the thermometers be so constructed as not to be liable to derangement in pulling up or letting down. For this reason a very carefully

made form of Six's thermometer has been adopted, something like those used at sea, but specially adapted to the circumstances. Two have been provided—one to show the highest and lowest temperature within a foot of the bed of the river, the other floating with the tide but always two feet below the surface of the water. Both thermometers hang in a perforated shaft, which reaches from nearly the bed of the river to far above high-water mark, in fact to a small chamber into which the thermometers will be wound for the purpose of reading them and setting the indices.

Besides these river temperatures, a set of air thermometers, &c., has been erected on a grass plot opposite to the offices, and these will supply all the data required from a climatological station, and a copy of the results will be forwarded to the Meteorological Society for publication, with other Metropolitan returns, in the *Quarterly Record*. These observations will be of considerable interest when compared with those on the Observatory Hill at Greenwich, which have so long been taken as representative of the climate of London.

In the organization of the river observations Mr. Symons has had the advantage of consulting Mr. W. H. M. Christie, F.R.S. (Astronomer Royal), and Mr. Ellis, under whose supervision the later river observations were made; and copies of the new river temperatures will be sent regularly to the Royal Observatory for examination and for publication in the *Weekly Returns of the Registrar-General*.

As regards the accuracy and efficiency of the instruments, it is probably unnecessary to say more than that they have all been made by Messrs. Negretti & Zambra, and all verified at Kew, and as regards accuracy in the observations, extreme simplicity has been aimed at, but at the same time several of the observations are made self-checking, while, as above stated, the river observations will be regularly checked at the Royal Observatory, and the climatological ones at the office of the Meteorological Society.

If any of our readers wish to see the instruments they can do so by presenting their cards at the principal entrance to the Foreign Cattle Market, Deptford, on Saturday, May 19th, between 3 and 5 p.m.

AN ARTIFICIAL AURORA.

WE are very glad to find in the last number of the *Mittheilungen der internationalen Polar-Commission* a full description of the experiments made by Prof. Lemström, of which we gave some newspaper reports in our last number.

Prof. Lemstrom's communication is too long for transfer to these pages, and, as we have just mentioned, has been anticipated by telegraphic reports. The opening chapter giving an epitome of the origin of the experiments is, however, so interesting that we give a translation of it, almost without abridgment :—

HISTORICAL INTRODUCTION.

"Amid the almost countless forms presented by auroræ, there is one of special interest as indicative of its origin. This form, which was observed during the Swedish Polar expedition of 1868, consists in thin flames or a phosphorescent glow surrounding elevated objects, and especially mountain tops. This characteristic is so marked that it needs no training to observe it, for it was observed by our celebrated philologist, M. A. Castrén, during his voyages in Siberia, and by him very tersely and accurately described.

"My first experiments in 1871 were suggested by what I had myself observed in Spitzbergen, and were directed towards ascertaining whether a similar appearance could not be produced, or at least, developed by suitable methods.

"Starting with the hypothesis that auroræ in general, and especially the above-named variety thereof, are due to electrical currents in the atmosphere, I erected on the summit of Luosmavaara, about 560 feet above Lake Enare* an apparatus composed of a corona of numerous fine points of copper wire united to a single copper wire, this coronet, about 8 in. square, was placed on the top of a tall pole. From it an insulated copper wire (0·015 inch in diameter) led to a galvanometer, which was placed in a room at the rectory of Enare, about 2½ miles distant; another copper wire was led from the galvanometer to a plate of platinum buried in the earth. When the connection between the coronet and the earth was broken, the needle of the galvanometer was appreciably, though but slightly, deflected. The very night (November 27th, 1881) after the apparatus had been erected an aurora began, the first manifestation being a single ray perpendicularly over Luosmavaara. This ray gave in the spectroscope the true greenish yellow auroral line, but it was not certain whether the ray was truly vertical over the mountain or behind it. Subsequent observations, which I will presently mention, render it nearly certain that the ray was produced by the apparatus.

"During the same expedition, but a few days earlier (November 21st, 1871) while studying the spectra of the flames on surrounding summits which, on that day, were somewhat brighter than usual, we found that the spectroscope gave the greenish yellow line from nearly all the surrounding objects, the ice of a pond, the roof of a house, and even (but very feebly) from the immediate vicinity of the observer. These observations led me to believe that I was then in the midst of a feeble aurora, and from that time onwards it has always been my wish to subject auroræ to further practical tests. This desire was also strengthened by an accident, viz., the appearance of light in a Geissler tube, which was not in direct connection with any electrical machine. For this accident led to researches which proved that the current which leaves one pole of an electrical machine, while the other pole is connected to earth, may pass obscurely through a stratum

* In Lapland, about 140 miles south-east of North Cape.

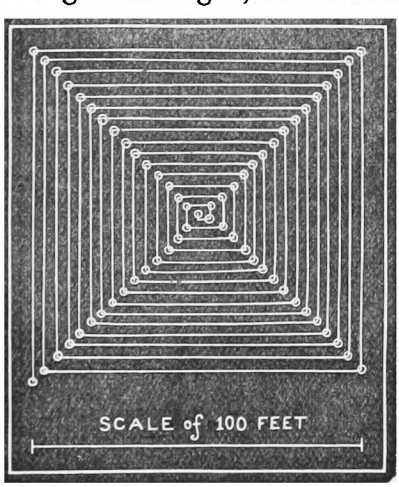
of air of ordinary density, but produce light in a stratum of diminished density.

"I must, however, reserve for another occasion many details, and pass at once to the origin of the present experiments.

"The information respecting auroræ which I gained by long experience, but especially the facts already mentioned, led me to believe that an experiment on a large scale, in which the principal part should be left to Nature, and her efforts should merely be assisted, would probably lead to positive results, and also furnish facilities for the study of the phenomenon.

"Although not certain of success, I felt it to be my duty to submit a proposal of this nature to the International Polar Commission at St. Petersburgh, in August, 1881."

Prof. Lemström then explains that various causes conspired to delay his operations, and that, finally, he had to start with somewhat makeshift apparatus. His first experiments made upon a clock-tower at Sodankylä were unsuccessful. He therefore removed his apparatus to the top of Oratunturi, a mountain 12½ miles from Sodankylä and in lat. 67° 21′ N, and lon. 27° 17′ E. The summit is about 1,798 feet above the sea, and 971 feet above the village of Sodankylä. His so-called discharging apparatus, placed on this summit, consisted of a stout copper wire, 0·08 inch in diameter, supported on insulators fixed to posts 8 feet high. The wire was arranged in a rectangular spiral, somewhat as shown in the annexed diagram, the posts being at the angles, and no two lines of the wire



at a less distance than 3 feet; the wire was studded with brass needle-points at each 20 inches. Judging from the description, the coronet must have contained about half-a-mile of wire, and been studded with more than 2,000 points. An insulated wire was led from the interior extremity of the spiral to a rough shed about 600 feet lower down the mountain, in which it was connected to a galvanometer, whence another wire was carried to "earth" in a small stream.

This apparatus was completed on December 5th, 1882, and thereafter there was nearly every night a yellowish-white light over the summit, though none was visible on any adjacent mountain. The light was a flashing one, that is to say, very variable in intensity, and always in motion. Examined on three occasions by the spectroscope at a distance of 2½ miles, it gave a feeble continuous spectrum from D to F, upon which could be observed the auroral line $\lambda = 5{,}569$ faint, and varying in intensity. The galvanometer always showed a positive current from the coronet to the earth. The temperature was, however, very severe, generally about – 20° F (52° below freezing), and the apparatus was constantly being deranged and damaged by the masses of hoar frost which formed upon it, destroying the insulation, and frequently breaking the insulated wire between the coronet and the cabin.

Subsequently Prof. Lemström erected a somewhat similar apparatus on Pietarintunturi, a mountain near "Kultala (lat. 78°32′ N. lon. 27° 17′ E.)" [There is some mistake here, probably this a place shown on the U. K. map as Kustala in lat. 67°50′ N. and lon. 25°35′ E. and about 40 miles N.W. of Sodankylä]. Here experiments were possible on only two days, but on the first of them, December 29th, 1882, an auroral streamer about 400 feet long was formed, which observations from several azimuths proved to be exactly over the apparatus.

What with anxiety to be certain of this, what with the difficulty of manipulating the apparatus in the temperature of about 20° below zero Fahrenheit, and what with the difficulty of separating the light of this streamer from that of a faint general aurora, no spectroscopic observation was made, but Prof. Lemström feels sure both from his experiments in 1871, from those at Oratunturi in the early part of December, 1882, and from the galvanometer readings on this occasion, that it would have given the true auroral line.

Prof. Lemström concludes with high praise to his assistants for their zealous aid in trying atmospheric conditions, and he certainly deserves the same himself, for he shared it all, and that the experiments were difficult, the following paragraph sufficiently shows :—

"Both sets of experiments were but of a temporary character caused by the difficulties which had to be overcome. In those at Oratunturi, the observer had first to travel 12½ miles, which took at least four hours, then to examine the whole of the apparatus, repair it where necessary, and clear it from hoar frost, and all this in a temperature far below zero. When all was ready, the extreme cold rendered the fingers so numb, that it was rarely possible to observe the galvanometer for more than 5 or 10 minutes without going to a fire to warm them. At Pietarintunturi, the distance to be travelled was much less, but it also was trying, as the observer had first to climb about 1,000 feet, and then to walk about two miles."

We congratulate Prof. Lemström on his success, and we rejoice in the fact that, as he lives under an Empire, the chiefs of which have

long been distinguished for their fostering care for scientific research, it may be taken for granted, that next winter will find him again in the Arctic circle, with apparatus thoroughly suited for the work. If that occurs, the days of the aurora remaining unexplained will probably soon come to an end, although, thus far, it seems as if the appearances produced were somewhat like those of a very diffuse St. Elmo's fire, or of a so called "brush discharge." But even if so, Prof. Lemström is the first to make or to see a St. Elmo's fire 400 feet long.

To the Editor of the Meteorological Magazine.

SIR,—The paragraphs produced under this head in the last number (April) of your Magazine claim considerable attention, but doubtless we still require more precise details before being able to pass a judgment upon them.

One point I feel I must touch upon. The vacuum experiments at the Polytechnic (dear to my boyhood) were then accepted in all faith, as illustrating the features and character of the auroral discharge. There was, however, no spectroscope in those days, and that strict analyser has now pronounced that all laboratory artificial auroræ, however much they may look like the northern lights, cannot by any persuasion or treatment be induced to yield the prominent and principal lines of the auroral spectrum, and, we may therefore conclude, are *not* of the same physical character. If Professor Lemström's experiments establish a permanent aurora, our chances of discovering its true nature will increase with its duration. Hitherto we have failed to discover any spectrum which, as compared with those of the aurora, will enable a lecturer to say, "Here, gentlemen, upon the table before you, you have in all respects a veritable auroral discharge." The spectra of stars, nebulæ, comets, &c., have been so seen in tiny glass tubes, but the aurora has baffled us hitherto.

Yours truly, J. RAND CAPRON.

Guildown, Guildford, April 18th.

THE METEOROLOGICAL SOCIETY.

THE usual monthy meeting of the Society was held on Wednesday evening, April 18th, at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair. T. G. Bowick, E. C. Clifton, H. Culley, Dr. W. Doberck, A. N. Pearson, Professor H. Robinson, C.E., and J. E. Worth were balloted for, and elected Fellows of the Society.

The following Papers were read:—

I. "On Cirrus and Cirro-Cumulus," by the Hon. F. A. Rollo Russell, M.A., F.M.S. The author points out that next to frequent readings of the barometer, and a knowledge of the distribution of atmospheric pressure, observation of the character of clouds, especially of cirrus, is of the greatest use in attempting to forecast coming weather. Observation of Cirrus can evidently be made use of in a

telegraphic system of weather forecasts, as easily as observation of the barometer, and the employment of a number of scattered cirrus observers largely increases the probability of the motions of this form of cloud being noted. The paper contains a description of twelve different varieties of cirrus with the weather they indicate, or at least precede, as observed by the author during the last eighteen years.

II. "Some Notes on Waterspouts; their Occurrence and Formation," by George Attwood, F.G.S. This contains an account of several waterspouts observed in the Pacific Ocean, and also one seen in the Atlantic Ocean. The author believes that the waterspouts in the Pacific Ocean, were caused by a cloud heavily charged with cooled moisture drifting from the high mountains of Costa Rica and coming into contact with air currents and clouds travelling in a different direction, and of a warmer temperature; by which contact the cloud heavily charged with moisture received a rotatory motion, causing it to discharge part of its moisture, and make it assume a cylindrical figure, and fall down by its own gravity.

III. "Records of Bright Sunshine," by W. W. Rundell, F.M.S. This is a discussion of some of the Sunshine Records made in the United Kingdom during the year 1881 and 1882, from which it appears that there is more bright sunshine upon the coast than there is inland.

IV. "Note on Wind, Cloudiness and Halos; also on results from a Redier's Barograph," by E. T. Dowson, F.M.S.

V. "On the Cold Weather of March, 1883," by W. Marriott, F.M.S. The weather of this month will long be remembered for its very cold, dry, and windy character. The winter had been very mild, dull, and wet, and continued so to the beginning of March. A sudden change, however, took place on the 6th; a severe northerly gale set in, accompanied by snow showers, This gale caused sad havoc among the fishing fleet on the east coast, no fewer than 382 men and boys being drowned. The temperature fell considerably, the maximum being below 40° in almost all parts of the country, and in the north of England only a trifle above the freezing point. The same conditions prevailed for the next two or three days, the temperature, however, falling still lower, and on the 10th the minimum occurred in the central and northern districts. The most remarkable weather of the month took place from the 21st to the 24th. Owing to a brisk fall of the barometer over France, an easterly gale was experienced over this country; and as the temperature was low and the air very dry, the wind was exceedingly bitter and keen, and its effect upon animal and vegetable life very serious.

GLOBE LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—I am much obliged by your remarks appended to my recent letter on this subject. Doubtless, so far as we know, the "slowness of motion," characteristic of this form of lightning, was missing in the Compton case; nor was any "explosion" mentioned as heard, unless the "crash of thunder" succeeding it was really such.

It is strange what vagaries lightning will sometimes play. I had recently brought to me a ball evidently largely composed of iron, spherical in shape, 14·38 oz. in weight, specific gravity 6·81. This had been found after a storm near the apparent place of fall of lightning, in a heap of refuse bark, thrown out from a barn door. In this heap was a round hole with charred sides, and at the bottom of this hole, 10 inches deep, was found the ball in question. As the finder was certain he had found a "meteorite," every means were taken by analysis, comparison, section, magnetic examination, &c., to ascertain its true character, and these proved it incontestably to be a charcoal smelted cast iron ball, probably of considerable antiquity, as charcoal furnaces have long ceased. There yet remained the charred hole to be explained, and upon seeking advice from Mr. Preece, he came to the conclusion that an offshoot from a flash of lightning, falling near even so small a mass, may have penetrated to it, and thus led to its discovery, and to the mistake about it.—Yours truly,

J. RAND CAPRON.

Guildown, Guildford, April 18th.

To the Editor of the Meteorological Magazine.

SIR,—Please afford a small space for the following brief note concerning a fire-ball, seen by my sister many years ago at the farm of Haggs, Glasford parish, Lanarkshire. She narrated the circumstances to me at the time, and last year I again questioned her on the subject. During a fearful thunderstorm the farm-hands were eagerly striving to cut and bring in a load of grass, but were obliged to give over in consequence of the lightning playing vividly on the scythes and forks. In the thick of the storm my sister saw a ball of fire, about the size of a boy's head, settle down on the ridge of a thatched outhouse. After remaining a few seconds, it fell gradually to pieces or powder, in a manner like to a shell of quicklime when slaked; the gleaming powder streaming down the thatch amid the pouring rain, but doing the roof no injury. If there was any noise from it, it was unheard.

I may add, that while my sister was resident there several years she frequently saw bog-fire wavering, flichteringly over the moss-haggs from which the farm took its name. But, as perhaps some New Forest naturalist may sigh,

Ah! Higher Culture's superseding
Poor old Spunkie's "Light and Leading."

HENRY MUIRHEAD, M.D.

Cambuslang, 30th April, 1883.

COMPLEX SYSTEM OF HALOS.

Sergeant Cardwell has sent us a drawing of a complex system of halos, observed by him from the Verne Citadel at Portland, on April 28th, 1883. As we find that he sent a similar drawing to the Editors of *Nature* and of the *English Mechanic*, in both of which journals it has been engraved, we do not reproduce it, especially as the engraving does not quite agree with the verbal description, owing probably to the absence of any angular measurements.

Unfortunately, there is no English work which treats the subject of halos in any detail, and up to the present time we are not aware that any complete nomenclature of halos has been proposed. It is nearly half a century since Prof. Bravais published his excellent *Mémoire sur les halos et les phénomènes optiques qui les accompagnent*, but no Englishman has had the courage to run the almost certain risk of pecuniary loss which the publication of such a work in this country would involve—unless, indeed, an author could be found well read in optics and a good colour draughtsman, for many of the phenomena are very beautiful, and the book might then possess a double claim, on art as well as on science. We have never seen the form sketched by Sergeant Cardwell, nor has it been sent to us before during the 17 years that the *Meteorological Magazine* has been in existence. Nor is there anything identical with it among the hundred or more varieties engraved in Bravais' *Mémoire*, but it has points in common with fig. 77 and with fig. 106, which represents a halo seen in 1684.

FOG GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—Since 1865 I have kept an account of the average amount of fog, but on quite a different plan from those suggested in your Magazine. My plan applies equally to clear as to foggy weather. I observe the distance to which objects can be seen, and record the amount of fog on the following scale :—

Distance visible,	32 miles	Fog	4
,,	8 ,, ...	,,	8
,,	2 ,, ...	,,	16
,,	880 yards...	,,	32
,,	220 ,, —	,,	64

and so on, in inverse ratio to the square root of the distance visible.

The objects observed are any solid bodies, such as buildings, leafy trees, and hills in the daytime, and at night ordinary gaslights. I disagree with the opinion expressed on your page 21, that "the measure of obscuration depends on the angle subtended by the object," believing that the size and colour of the object make very little difference as to its visibility, which depends almost entirely on the amount of fog between it and the eye, and therefore on its distance. For a similar reason I often use an opera-glass, though at

other times the naked eye. As regards the lamps, no doubt a bright light is visible further than a small one, yet I do not think there is so much difference in this respect as you seem to suppose. I have an impression that a common gaslight is visible rather further at night than a dark object is in the daytime, but, as it is impossible to compare the two simultaneously, I cannot say whether this is so, and I do not think that the difference can be great.

The visibility of distant objects depends a good deal on their height, as the atmosphere is usually clearer high up than low down; at other times, however, the reverse is the case, so that the amount of fog recorded partly depends on the altitudes of the objects observed. My plan, therefore, is not an exact means of comparison between observations at different places, because the hills in view may differ in height; but where they are approximately of the same height, I think this plan would form a fair means of comparison. Also this difficulty does not usually affect actual fog, but only haze.

It was a difficult matter to decide on the scale to be adopted, in order to give satisfactory results in taking the averages. The simplest plan would be to let the distance visible represent the fog (or rather clearness, as in that case it would be), but this obviously would not do, for in taking the average, the densest fogs would affect the average only about as much as slight ones. Nor would a scale on the *simple* inverse ratio do, for in that case a very clear day would have no more perceptible effect than a moderately clear one. The scale I have adopted gives satisfactory results, though I am not sure whether a logarithmic scale would not be fairer still, as, for instance:—

Distance visible,	**32**	**miles**	...	...	...	...	**Fog**	**6**
,,	16	,,	...	...	...	...	,,	7
,,	8	,,	...	...	...	...	,,	8
,,	4	,,	...	...	...	...	,,	9

and so on.

THOS. WM. BACKHOUSE.

Sunderland, 24th April, 1883.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	57 2	27	24·5	12	44·3	35·5	38·5	93	73·6	21·4	2·51	16	8·1
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·6	30	71·0	18	81·9	74·2	68·4	74	...	...	4·83	24	6·3
Calcutta	79·6	16	51·9	23	77·4	57·5	57·0	73	136·7	38·5	·00	0	1·8
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	89·5	8	66·2	16	84·6	69·4	66·1	69	144·2	54·3	·00	0	0·7
Ceylon	88·9	18	67·6	13	84·8	72·8	67·0	68	151·0	58·0	8·26	9	5·8
Melbourne	96·2	28	47·1	1	75·3	53·7	50·2	64	152·5	39·2	3·13	10	5·4
Adelaide	101·7	27	51·4	24	82·8	59·1	49·5	46	170·6	42·7	·37	6	4·6
Wellington	79·0	24	48·0	28	68·3	56·2	...	...	137·0	45·0	1·79	10	...
Auckland	79·2	9	52·2	28	72·9	58·1	55·1	70	135·5	41·8	1·37	8	5·9
Falkland Isles	69·1	16	36·5	20	55·6	41·8	43·1	76	134·2	27·9	2·58	15	6·9
Jamaica	89·6	10	67·8	31	86·1	70 9	69·1	78	...	58·0	·35	4	4·9
Barbados	81·0	var.	69·0	19	80·0	72·0	71·3	80	146·0	67·0	3·45	15	6·0
Toronto	40·1	4	4·1	9	30·9	20·0	23·8	83	101·0	—0·4	2·79	23	8·7
New Brunswick, S. John	48·0	6	5·0	29	28·8	15·5	20·4	89	...	...	2·82	14	5·2
Cape Breton, Sydney	49·9	6	13·2	29	35·2	23·8	26·3	84	...	...	2·42	16	7·1
Manitoba, Winnipeg	27·4	19	–32·1	15	9·3	—7·1	7·3	84	83·0	...	2·00	11	5·4
British Columbia	54.0	16	21·0	31	43·2	34·7	38·3	94	...	...	12·52	21	6·3

REMARKS, DECEMBER, 1882.

Mauritius.—Rainfall 1·16 in. below the average; mean temp. about the average; mean pressure, 30·031 in.; mean hourly velocity of wind 10·4 miles, extremes 25·5 miles, on 13th, and 1·6 miles, on 4th; T and L on 3rd, 5th, 20th, and 23rd, and L on 9th. C. MELDRUM, F.R.S.

Melbourne.—Mean pressure and temp. of air and of dew point slightly below the average of 24 years; humidity about the average, amount of cloud below it; rainfall ·77 in. above it; prevailing direction of wind S. and S.W., strong breezes occurring on eleven days; heavy dew on nine days; H on 14th; heavy TS on 5th; T and L on 7th and 13th; T on 9th and 14th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (29·942 in). and mean temp. (91°·0) the same as the average of 26 years; on the whole the month was remarkably cool, the mean being attained by some occasional hot days. Rainfall ·612 in. below the average of 43 years. C. TODD.

Wellington.—Showery and very close on 2nd, 3rd, and 4th; from 5th to 10th, pleasant, with cool breezes, from S. and S.W.; fine from 11th to 17th, with very strong N.W. winds; heavy R on 18th; stormy on 20th and 21st; fine and pleasant from 22nd to 26th; showery from 27th to 29th; close of month fine. Prevailing winds, N.W. Mean temp. 62°·2, 1°·1 above the average. R. B. GORE.

Auckland.—Weather mostly bright and hot, with light winds; cloudy at the commencement of the month; very little R; barometric pressure much above the average. E. B. DICKSON.

BARBADOS.—Mean temp. 76°·0, 1° above the average of 25 years; average velocity of wind 14 miles per hour, extremes 19·5 miles and 0 miles; rainfall 60 per cent., and evaporation 13 per cent. above the average; only one day was overcast.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·52	XI.	Llanfrechfa Grange	·85
,,	Margate, Birchington...	1·23	,,	Llandovery	·90
,,	Littlehampton	1·38	,,	Solva	1·37
,,	St. Leonards	1·82	,,	Castle Malgwyn	2·41
,,	Hailsham	1·53	,,	Rhayader, Nantgwillt..	1·14
,,	I. of W., St. Lawrence.	1·56	,,	Carno, Tybritle	1·05
,,	Alton, Ashdell.....	1·26	,,	Corwen, Rhug	...
III.	Great Missenden.....	...	,,	Port Madoc	1·29
,,	Winslow, Addington ...	1·34	,,	I. of Man, Douglas	1·47
,,	Oxford, Magdalen Col...	1·07	XII.	Carsphairn	3·64
,,	Northampton	1·74	,,	Melrose, Abbey Gate...	1·45
,,	Cambridge, Beech Ho...	2·26	XIII.	N. Esk Res. [Penicuick]	1·05
IV.	Southend	1·41	XIV.	Ayr, Cassillis House ...	·55
,,	Harlow, Sheering	1·84	,,	Glasgow, Queen's Park.	2·02
,,	Diss	1·00	XV.	Islay, Gruinart School..	1·93
,,	Swaffham	1·23	XVI.	St.Andrews, NewtonBk	1·75
,,	Hindringham	2·16	,,	Aberfeldy H.R.S.	...
V.	Salisbury, Alderbury...	·96	,,	Dalnaspidal	2·41
,,	Warminster	1·22	XVII.	Keith H.R.S.	1·18
,,	Calne, Compton Bassett	·82	XVIII.	Forres H.R.S.	1·03
,,	Beaminster Vicarage ...	1·46	,,	Strome Ferry H.R.S....	1·91
,,	Ashburton, Holne Vic..	1·73	,,	Lochbroom	1·93
,,	Torrington, Langtree W.	1·41	,,	Tain, Springfield.....	...
,,	Lynmouth, Glenthorne.	1·12	,,	Loch Shiel, Glenaladale	3·99
,,	Probus, Lamellyn	2·02	XIX.	Lairg H.R.S.	1·46
,,	Taunton, Fullands	1·02	,,	Forsinard H.R.S.	1·26
VI.	Bristol, Clifton	·86	,,	Watten H.R.S.	1·28
,,	Ross	...	XX.	Fermoy, Glenville	2·83
,,	Wem, Sansaw Hall.....	...	,,	Tralee, Castlemorris ...	2·17
,,	Cheadle, The Heath Ho.	1·94	,,	Tipperary, Henry Street	2·18
,,	Worcester, Diglis Lock	·83	,,	Newcastle West	1·73
,,	Coventry, Coundon	1·23	,,	Kilrush	...
VII.	Melton, Coston	2·46	,,	Corofin	1·39
,,	Ketton Hall [Stamford]	2·57	XXI.	Carlow, Browne's Hill..	2·27
,,	Horncastle, Bucknall ...	1·55	,,	Navan, Balrath	1·22
,,	Mansfield, Market Place	2·97	,,	Athlone, Twyford	2·37
VIII.	Macclesfield, The Park.	1·82	XXII.	Mullingar, Belvedere ...	2·12
,,	Walton-on-the-Hill.....	1·18	,,	Clifden, Kylemore	4·88
,,	Lancaster, South Road.	1·90	,,	Crossmolina, Enniscoe..	2·06
,,	Broughton-in-Furness ..	...	XXIII.	Carrick-on-Shannon ...	1·18
IX.	Wakefield, Stanley Vic.	2·85	,,	Dowra	2·03
,,	Ripon, Mickley	3·03	,,	Rockcorry.....	1·54
,,	Scarborough.....	1·10	,,	Warrenpoint	2·23
,,	East Layton [Darlington]	2·43	,,	Newtownards	1·54
,,	Middleton, Mickleton ..	1·30	,,	Belfast, New Barnsley..	1·66
X.	Haltwhistle, Unthank..	1·26	,,	Bushmills	1·09
,,	Shap, Copy Hill	2·08	,,	Buncrana	1·53

APRIL, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·56	— ·46	·60	18	9	68·9	5	29·3	9	3	7
II.		Maidstone (Hunton Court)...	1·63	— ·22	·53	27	10	...	...	...	...	...	...
,,		Strathfield Turgiss	·95	— ·96	·49	27	9	67·4	5	25·8	9	7	23
III.		Hitchin	1·67	— ·28	·48	28	9	62·0	3	27·0	8	6	...
,,		Banbury	1·08	— ·93	·25	18*a*	9	63·5	5	26·5	1	7	...
IV.		Bury St. Edmunds (Culford)	1·34	— ·45	·48	19	12	70·0	18	24·0	8	7	..
,,		Norwich (Cossey)	1·71	— ·15	·56	20	9	68·5	18	22·0	7	7	8
V.		Bridport	·94	...	...	...	...	...	..	...	...	...	...
,,		Barnstaple.....	2·05	— ·33	·70	30	9	65·0	29	32·0	25	1	..
,,		Bodmin	2·20	— 1·13	·58	26	13	58·0	14	31·0	1	1	20
VI.		Cirencester	·74	— 1·66	·19	28	6	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	·91	— 1·41	·30	18	9	63·0	5	31·0	24*d*	3	16
,,		Tenbury (Orleton)	1·16	— ·71	·27	28	10	67·7	4	25·3	1	8	14
VII.		Leicester	2·15	...	·72	28	12	66·9	4	27·0	1	6	17
,,		Boston	1·64	— ·25	·50	24	9	66·0	5	29·0	1	2	...
,,		Grimsby (Killingholme).....	1·40	— ·36	·37	19	15	64·0	18	28·5	9	2	...
,,		Hesley Hall [Tickhill].....	2·23	...	·69	28	9	66·0	4,18	25·0	1	5	...
VIII.		Manchester (Ardwick).....	1·70	— ·33	·72	29	8	59·0	2, 3	31·0	1	2	...
IX.		Wetherby (Ribston Hall) ...	2·04	— ·47	·82	29	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·11	+ ·05	1·12	28	11	64·0	8,9	28·0	6	...	...
X.		North Shields	1·23	— ·77	·40	28	9	63·0	18	29·0	1	6	8
,,		Borrowdale (Seathwaite).....	5·00	+ ·06	1·37	29	8	62·1	27	26·5	25	...	...
XI.	WALES.	Cardiff (Ely).....	·89	— 1·45	·42	26	7	...	...	...	...	...	...
,,		Haverfordwest	2·18	— ·64	·81	18	9	62·1	12	28·0	7	8	22
,,		Plinlimmon (Cwmsymlog) ...	1·58	...	·62	18	9	...	...	...	..	...	...
,,		Llandudno.....	·83	— 1·05	·39	18	9	62·4	2	32·5	23	0	...
XII.		Cargen [Dumfries]	2·19	— ·10	1·24	28	10	61·0	11	26·8	25	5	...
,,		Hawick	1·24	— ·97	·28	19	9	...	...	...	...	...	...
XIV.		Douglas Castle (Newmains)	2·13	+ ·25	·70	28	10	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	3·44	+ ·81	·96	28	16	...	...	27·0	24	10	...
,,		Appin (Airds)	2·26	...	...	...	...	...	...	...	...	..	
,,		Mull (Quinish).....	3·43	...	·81	2	16	...	...	...	..	...	...
XVI.	SCOTLAND.	Loch Leven Sluices	1·60	— ·61	·30	6*b*	9	...	...	...	...	...	...
,,		Arbroath	1·61	— ·30	·43	19	9	57·0	7	33·0	1	0	...
XVII.		Braemar	1·72	— ·36	·45	18	11	57·0	8	2·50	23	4	21
,,		Aberdeen	1·74	...	·48	19	11	62·0	7	35·0	5, 15	0	...
XVIII		Skye (Sligachan)	6·42	...	3·04	3	13	...	...	...	...	..	...
,,		Culloden	·97	— ·38	...	...	...	58·5	30	29·0	24	3	14
XIX.		Dunrobin	1·11	...	·26	4	10	59·5	11	33·5	1	0	...
,,		Orkney (Sandwick)..... ..	1·75	— ·12	·46	19	12	53·9	29	33·8	1	0	0
XX.		Cork (Blackrock).....	2·92	— ·18	·98	26	17	69·0	9	30·0	8	5	...
,,		Dromore Castle	4·89	...	1·00	28	17	60·0	9*c*	30·0	20*e*	6	...
,,		Waterford (Brook Lodge) ...	2·71	...	1·32	26	11	64·5	9	28·5	8	2	...
,,		Killaloe	1·82	...	·46	2	10	64·0	20	25·0	26	10	...
XXI.		Portarlington	2·01	— ·02	·96	26	15	63·0	9	31·5	23	4	...
,,	IRELAND.	Dublin (FitzWilliam Square)	2·21	+ ·10	1·39	26	10	60·0	4	34·3	8	0	1
XXII.		Ballinasloe	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	1·64	— ·25	·48	26	13	66·0	8	30·0	5, 13	15	18
,,		Londonderry (Creggan Res.).	1·63	...	·54	4	13	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·52	— ·48	·28	2, 4	17	58·0	8,10	31·0	3,5*f*	10	...

+ Shows that the fall was above the average; — that it was below it.

a And 27. *b* And 25, 29. *c* And 10, 12, 13. *d* And 25. *e* And 22, 24. *f* And 24.

METEOROLOGICAL NOTES ON APRIL.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—True "Blackthorn" weather the greater part of the month, more genial towards the close; meadows and trees much blighted by the cold winds; spring-sown grain looking well. First swallow seen on 12th. Cuckoo first heard on 17th, nightingale on 21st; cowslip in flower on 2nd: marsh marigold on 10th, garden strawberry on 28th.

BANBURY.—Mean temp. 45°·8, about the average; S and H on 23rd.

CULFORD.—The month was unusually cold; but the early part being dry was favourable for agricultural work; distant T on 17th, S on 18th and 22nd.

COSSY.—A dry cold month; wind between S.E. and N.E. on 24 days; vegetation very backward.

CIRENCESTER.—A very dry month, of great service to the agriculturist in cultivating the land, which was in a very bad state from the previous long continued excessive rainfall; S on 23rd.

WOOLSTASTON.—A cold ungenial month, mean temp. 46°·4; swallows late in arriving, and very few in number; S on 23rd.

ORLETON.—At the beginning of the month there were several warm days; but afterwards it was generally cold, with bright days and many frosty nights; mean temp. 1°·3 below the average of twenty years; no R fell on the first twelve days, and the quantity afterwards was small, not greatly exceeding half the average. S covered the ground on the morning of the 23rd; the wind was generally N.E., and frequently very strong and cold; a very favourable month for farming operations on clay soils. Swallows first seen on 16th, whitethroat on 19th, and the cuckoo was first heard on the same day.

LEICESTER.—The early part of the month was dry and warm, no rain falling till the 12th; the latter part was cold and stormy, S and H fell on the 23rd, and heavy R on the 28th causing floods on the following day.

KILLINGHOLME.—A very favourable seed time, but pastures are very bare; good promise of blossom on apple and pear trees; swallow first seen on 15th.

SEATHWAITE.—A dry and cold month; S on mountains on 22nd.

WALES.

HAVERFORDWEST.—A remarkably fine dry cold April; mean temp. 46.°9, prevailing winds N. and E., grass temperatures particularly low, and frosts very frequent; the pressure was high during the first eleven days, but decreased after the 19th, and was low during the last week; about the 17th the wind backed to S.W., and very cold R fell mixed with S, the highlands being quite white on the 18th; vegetation very backward.

LLANDUDNO.—A fine dry month, with 132 hours of bright sunshine; the mean temp. was 2°·6, and the rainfall much below the average; the number of wet days was also small; mean humidity 74, three below the average; no frost. S on 23rd and 24th, and on the distant hills from 1st to 18th, and again towards the close of the month. Swallows first seen on 22nd. Cuckoo first heard on 28th.

SCOTLAND.

CARGEN.—A cold backward month, vegetation severely checked; mean temp. 2·°2 below the average, sunshine 37 hours below the average. T on 18th.

HAWICK.—The first half of the month was genial and spring-like, the latter half very cold with prevailing E. winds; heavy S showers fell on the 23rd and 24th, and remained on the hills, and a keen frost occurred on the night of the 25th.

ABERDEEN.—Dry bracing weather was experienced throughout the month; rainfall nearly an inch below the average; vegetation made rapid progress; vivid aurora on 3rd; H and sleet on 24th.

SLIGACHAN.—The first week was warm, with a very heavy fall of R on the 2nd, during the remainder of the month cold winds prevailed, checking vegetation, but the weather was favourable for sowing.

CULLODEN.—The month was particularly dry, with easterly winds and cold nights.

SANDWICK.—In April we had a very favourable change from the frosts and storms of March to milder, drier, and calmer weather; during the first sixteen days the wind was always from S. or W., after that date easterly; gales of forty miles an hour occurred on the 15th and 28th, and one of fifty miles on the 18th; aurora on 3rd.

IRELAND.

DROMORE.—A cold month; severe for all vegetation, grass on meadows and pastures very backward.

WATERFORD.—Rainfall below the average; prevaling winds S.E.; vegetation very backward; T on 18th; Cuckoo heard on 19th, martins seen on 17th.

KILLALOE.—Sharp cold winds from N.E. and S.E. prevailed throughout the month; temp. below the average.

DUBLIN.—A cold dry month E. and S.E. winds prevailing though not to such an extent as during March; the mean temp. was 1°·6 below the average of 18 years, but the extremes were not great; though the rainfall was above the average, the month is fittingly described as dry, rain falling on only 10 days, the average being 16, and 85 per cent. of it during 36 hours on the 26th and 27th; the amount of cloud was moderate and much sunshine was enjoyed. Auroræ were seen on 3rd, 9th, and 24th; H fell on 19th and 23rd; a dense fog prevailed on 12th.

WARINGSTOWN.—A splendid month for labour, but vegetation very backward, altogether one of the latest springs remembered.

LONDONDERRY, CREGGAN RESERVOIR.—Very favourable weather during the month.

EDENFEL.—As a seed time the month was very favourable, but N. and E. winds prevailed almost continuously, which coming after so cold a March greatly retarded vegetation; in fact, there was but little spring weather; swallows arrived on 19th; cuckoo and corn-crake on 27th.

MEASUREMENT OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—I cannot help thinking Mr. Stow close to the mark in urging that the one-twelfth measure can only give very rough results. During the snow storm of January, 1881, I made some careful experiments by filling a copper 3 in. cube, as to 1 and 2 on the same day, and all with the same fall. The results were as under:—

(1) *Loose* snow melted into about one-fourth of its bulk of water; (2) *Compact trodden down snow* into one-third of its bulk; and (3) *Snow compressed by its own weight during the previous night's thaw* into seven-twelfths.

Evidently the melting or weighing process is the only one to be depended on where accuracy is required.—Yours truly,

J. RAND CAPRON.

Guildown, Guildford, April 18th, 1883.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCIX.] JUNE, 1883. [PRICE FOURPENCE. or 5s. per ann., post free.

TRUE TIME.

WE believe that there has been during the last 20 years a marked increase in the attention bestowed by meteorological observers on the accurate timekeeping of their clocks and watches. But we are convinced that there is room for much further improvement. For instance, we do not believe that more than one observer out of twelve could state with certainty and accuracy the precise minute at which he reads this line. There would be mental discussion. "Well, my watch was two minutes fast when I was at the station on Monday, and so it ought to be about right now," or "Oh, the Hall clock gains about three minutes a week, and as this is Saturday, it must be three minutes fast." Forgetting that as the said clock in all probability has an iron rod from its pendulum, the rate of gain depends on the temperature. How many observers keep a regular record of the errors of their clocks or watches? A few do, but scarcely one in twenty.

We do not like repetition, but as we hold this matter to be one of great importance, we purpose reprinting portions of various articles and letters which have appeared in this Magazine in the hope that the collective arguments and facts may have greater force than anything that we could say.

The first article which we quote shows that from the gross inaccuracy of the records of the time of the earthquake of October, 1868, it was impossible to determine its point of central action, although records were obtained from 71 stations.

EARTHQUAKE OF OCTOBER 30TH.

"If anyone wanted evidence of the prevailing ignorance as to correct time—we do not mean time true to seconds or tenths of a second, but correct to a minute—he would be abundantly supplied by the last earthquake, which we believe really occurred at 10 35 p.m., but which is reported to have been felt at all sorts of times within half an hour thereof. We put the subject prominently forward, because we think many observers are not so careful as they should be to have some one clock or watch about the correctness of which there should be no doubt. Let us give just one instance of the necessity of so doing, and an instance which will bring us back to our subject. Earthquake shocks travel at the rate of about 14 miles per minute, therefore as the shock was felt at Pembroke and Blackheath (210 miles apart), and at Liverpool and Torquay (200 miles apart), it is abundantly clear that if the times had been taken with

any approach to correctness, we should have known considerably more about the shock then we now do. For instance, if it was a surface shock travelling S to N., it should have been a quarter of an hour earlier at Torquay than at Liverpool, and of course the time should get gradually later at intervening stations, instead of which it is irregular in the extreme. The theory has been propounded that these last earthquakes have their origin not in the ordinary subterranean regions of volcanic fires, but much nearer the surface, in the explosion of large accumulations of gas in the coal measures. If this were the case, the time would have varied considerably, in circles, having the site of explosion for their common centre; but, as we have before stated, the recorded times are so discordant as to be of very little use. If we could have relied upon their being within three or four minutes of correct, we might have done something in the matter."—*Meteorological Magazine*, Nov., 1868.

A remarkably fine meteor was seen in the early evening of November 6th, 1869; we received thirty or forty accounts of it, the real time at which it occurred was, we believe, 6·52 p.m., but the times quoted were dreadfully discordant, ranging from 6·30 to 7 p.m. This, jointly with the receipt of a copy of Mr. Warner's book "*How to keep the Clock right*," led to the insertion of the following article:—

TRUE TIME: HOW TO GET IT AND HOW TO KEEP IT.

"The extreme inconsistency exhibited by the numerous accounts of the meteor, which we publish and comment upon elsewhere, must plead our excuse, if any be needed, for referring to horological matters in a publication devoted to meteorology; but many cases will occur to observers in which correctness of time is of the first importance; rate of progress of earthquake shocks, and particular gusts of wind, identity of luminous meteors, and a score of other facts lose all their value if some clocks are right and some are wrong—and the majority are wrong, more or less. Nor is this much to be wondered at, for there is hardly a town in England in which two watchmakers (watch-*menders* is a more proper term) have shops with so called "regulators" conspicuously placed therein and marked on the dial "Greenwich Mean Time," which said regulators will not differ by *several minutes*. We willingly exclude some few, who, by the equipment of small observatories and other means, secure accuracy worthy of high praise, and where one such firm exists in a town, the owners of such shops as we refer to generally copy them, and ofttimes secure the credit. We write of the majority, and recognise a few honourable exceptions. Even in London, where several clocks are actually controlled from Greenwich, errors of many minutes are by no means rare; and in country towns matters are worse. Hence it is clear, either that there is some great difficulty in "keeping the clock right," or that the very people whose business character ought to be imperilled by themselves, of all people, not knowing "what's o'clock," must be excessively negligent. We incline to the latter opinion because telegraphic communication has now been extended to most towns, and an approximation to true time may generally be obtained from the telegraph clerks. If therefore the provincial tradesmen neglect so simple a mode of keeping near the mark, we cannot acquit them of negligence. But with private observers living at a distance from telegraph stations, and communication with centres of population, the case is different; they must fall back upon the timepiece in the sky, but how are they to read it—by the sun alone? or by any of the glittering host which may be convenient? surely by the latter—but how?

"Here we cross the Rubicon from meteorology to astronomy, and in our further consideration of the question, we shall doubtless exhibit want of familiarity with astronomical matters, but if by so doing we induce those who are therewith connected to come to the help of those who need it, our notice will not be in vain. Let us premise that what we conceive to be required is some apparatus which shall be (1) very simple (both in construction, and in the mode of observing, (2) very durable, (3) low in price,

£2 or £3, (4) which shall give results, not liable to greater errror than 10 seconds, (5) which shall be available for taking time from sun, moon, or stars. From the above it will be evident that we by no means contemplate advising our meteorological readers to engage in costly or difficult astronomical observations, or that we wish for extreme accuracy, and we venture to think that the object is one not utterly beneath the notice of our astronomical readers.

"What means at present exist? The sun-dial, oldest of all chronometers, and one which well made, well and firmly fixed, is not to be despised. Price lists before us indicate that a first-rate sun-dial is charged several guineas, and we never saw one which could be read to anything like the accuracy we mention. Then come dipleidoscopes, a considerable improvement on sun-dials, but in their best and only accurate form also dear. Transit circles have hitherto never been quoted under £10 or £20, so they too must be very much simplified, or excluded from consideration. Jupiter's Satellities are very handy, and as ordinary telescopes, such as most observers possess, will show their phenomena, they involve no outlay, but for several months in each year they are not available.

"What, then, is anyone to do who wishes to keep his clock right? We fear Mr. Warner's book*, recently published, will not tell him, for he expressly states that he has not yet decided on the best form of telescope, but he proposes when that is determined, that it should be rigidly fixed to a perfectly solid pillar, and that it should have wires somewhat like Cary's Portable Transit, but with an improvement, viz., two vertical wires instead of one, and a wooden case to shut over and protect it from weather. There is no intimation of cost, and we venture to think that the instrument is inferior to the portable transit. The author has evidently taken very great pains in preparing the tables appended to the work, which are designed as a substitute for the Nautical Almanack, but we confess we prefer our old friend, the Nautical.

"In conclusion, we venture to hope that some of our astronomical readers, some optician, or some horologist, will tell us how simply, easily, and cheaply to get true time and to keep it."

In subsequent numbers during 1869 and 1870 attention was called to a form of the old meridian dial, and also to Dent's Dipleidoscope. If there should be any considerable demand for an instrument giving time by observations of the *sun only*, and required to be true only within five seconds, we believe that a pattern of meridian dial, fulfilling these conditions, could be brought out by opticians for sale at one guinea.

As regards the meridian dial, we think that it may be of interest to place upon convenient record, that which we believe to be the earliest description of the arrangement in its most simple form. The book seems to be scarce (it is not quoted in the bibliography of English Horological works in the *Horological Journal*) and we, therefore, reprint the title page, as well as the three pages descriptive of the early form of meridian dial.

---

* *How to keep the Clock right.* By T. WARNER. Cloth, 8vo, 77 pages. Williams and Norgate.

Horological Disquisitions

Concerning the

NATURE of TIME

AND THE

Reasons why all Days, from Noon to Noon, are not alike Twenty Four Hours long.

In which appears the Impossibility of a Clock's being always kept exactly true to the Sun.

With TABLES of EQUATION, and Newer and Better RULES than any yet extant, how thereby precisely to adjuft ROYAL PENDULUMS, and keep them afterwards, as near as possible to the apparent Time.

With a TABLE of PENDULUMS, shewing the BEATS that any Length makes in an Hour

A Work very necessay for all that would understand the true way of rightly managing Clocks and Watches.

By *JOHN SMITH*, C.M.

To which is added,

The best Rules for the Ordering and Use both of the Quick-Silver and Spirit Weather Glasses: And Mr. *S. Watson's* Rules for adjusting a Clock by the *Fixed Stars*.

LONDON: Printed for *Richard Cumberland* at the *Angel* in *S.* Paul's *Church-Yard*. 1694.

(90)

JUst when the last Sheet was ready to be printed off, that which follows was communicated to me by Mr *Watson*, the Person before-mentioned in this Work, which in respect of its Nature, being not only plain and useful, but also free from all Objections that Tables may be liable to, I have thought fit to add it hereunto, upon his Recommendation, and in the Words penn'd by himself.

SIR.

I *Rather communicate this to you, because many Gentlemen have the Convenience of Places fit for this way of Observation which I take to be the most exact Way yet found to adjust a Pendulum Clock well. If you think it may be serviceable to those that are the most exact and curious in Time-keeping, you may do well to insert it in that laborious and curious Tract of the* Equation of Natural Days, *that you are now publishing. I am,*

Your real Friend
and humble Servant,

S. W.

(91)

The Way of finding how much a Pendulum Clock *has gained or lost in a Day, Week or a Month, to the nicity of Two or Three Seconds, &c.*

N.	h.	′	″	N.	h.	′	″	N.	h.	′	″
1	0	3	56	12	0	47	11	22	1	26	30
2	0	7	52	13	0	51	7	23	1	30	25
3	0	11	48	14	0	55	2	24	1	34	21
4	0	15	44	15	0	58	58	25	1	38	17
5	0	19	39	16	1	2	54	26	1	42	13
6	0	23	35	17	1	6	50	27	1	46	9
7	0	27	31	18	1	10	46	28	1	50	5
8	0	31	27	19	1	14	42	29	1	54	1
9	0	35	23	20	1	18	38	30	1	57	57
10	0	39	19	21	1	22	34	31	2	1	53
11	0	43	15								

TAke a Piece of thin Brass, and file therein a Slit or Notch, about half a quarter of an Inch deep, but somewhat wider at the Top than at the Bottom, as thus knock the End of it into some Post in your Back-side, or else in some Window, that ye think convenient; then look through the Notch at any Star of the first or second Magnitude, and wait till the Star comes to the Edge of any Chimney, or the Side of any House, and you will see the Star vanish in a Moment; then mark what your Clock is at when

when the Star vanishes: Then at any other Night afterwards (as the next Night, or a Week or a Month afterwards) wait for the same Star again till it vanish behind the Chimney or House, as before, and then observe what your Clock is at, then your Clock should shew the second Time of vanishing so much sooner than the first, as this Table shews; now the farther off the Chimney or Wall is the more exact will the Observation be. Let the Distance be Ten Yards at least, let the Observation be made in any part of the *East*, *South* or *West*, but little towards the *North Pole*, because the *Polar Stars* are not so fit for this Purpose.

EXAMPLE.

Suppose a Star vanishes this Night at Nine Hours, Three Minutes and Four Seconds, by my Clock, and Eight Nights after I observe it again, and it then vanishes at Eight Hours, Thirty four Minutes and Forty two Seconds; by my Clock, againſt Eight Nights, in the Table, I find Thirty one Minutes Twenty seven Seconds; that is, so much sooner should the Star vanish at the second Observation than it did at the first; therefore substracting 31′ 27″ from the first Observation 9h. 3′ 4″. there's left 8h. 31′ 37″, the true Time that the Clock should have been at in the second Observation; therefore seeing the Clock was then at 8h. 24′ 32″, it has gained 2′ 55″.

FINIS.

During 1870 and 1871, the subject of good and cheap clocks was discussed in these pages, and the discussion was continued in the *Horological Journal* and in the *English Mechanic*, but nothing very satisfactory resulted. The good time-keeping qualities of the clocks known as "Austrian regulators" was pointed out, and Mr. Evans of Mount Street, Grosvenor Square, announced that he had designed and made some clocks such as he considered were required, the cost of which would be £12 each. He thought it unreasonable to expect an accurate timekeeper for any such sum as £5.

For twelve years there has been little progress made except the gradual spread of the postal telegraphs, and of the knowledge that the signal sent by the Royal Observatory at 10 a.m. is forwarded to every telegraph office in England and Wales. These, with the improved supervision of railway station clocks, have undoubtedly made matters far better than they were. In fact, we have a marked proof of progress in a pamphlet just received,* where there are 17 records of the time of an auroral appearance; they all agree within 15 minutes, 58 per cent. of the observations agree within one minute and 82 per cent. within three minutes. In the case of the meteor in 1869 there was a range of 35 minutes between the earliest and latest time quoted, only 38 per cent. agreed within a minute, and only 63 per cent. within three minutes. The 1882 observations were therefore about twice as good as those in 1869.

We are very glad to welcome help towards further accuracy, and we are sure that the energetic way in which Mr. Latimer Clark has taken up the subject will be very effective. We strongly recommend to the notice of our readers the two books† which he has published for the use of those who desire by day or by night to have the means of obtaining time, true to a single second.

Mr. Clark, in his treatise, uses extremely plain language, because, as he says on the title-page, and more fully in the preface, "The book is not designed for the use of physical students of the modern type, but is rather intended for those who, living in the country, have devoted their leisure to pursuits of a widely different character, who know nothing of physical science beyond its name, and who would never dream of opening a book on Astronomy." But Mr. Clark has done more than write these books; he has designed and brought out an extremely solid, durable, and, if we may so say, practicable form of transit instrument at about one-third of the price hitherto charged. In his first work on the subject he states that, having regard to the fact that the cost of transit instruments had prevented their more general use, he had placed himself in communication with

* The Auroral Beam of November 17th, 1882, by J. Rand Capron, F.R.A.S., F.M.S.

† A Treatise on the Transit Instrument, as applied to the determination of time. For the use of country gentlemen. By LATIMER CLARK, M.I.C.E., &c. London: A. J. Frost, 6, Westminster Chambers, S.W. 1882.

Transit Tables for 1883. Same author and publisher.

manufacturing opticians, and had obtained an instrument of high quality, with a 14 in. telescope and $1\frac{1}{8}$ in. aperture for £8, and had arranged for the supply of such instruments by Mr. A. J. Frost, of 6, Westminster Chambers, S.W. Mr. Clark added to this statement that "He will nevertheless endeavour to obtain a still more economical form of instrument, and if successful will publish the result." We sincerely hope that his efforts will not be in vain, for we cannot expect to see a Transit instrument in every rectory until the price is still further reduced.

As regards Mr. Latimer Clark's books, we feel inclined to object to only two matters. We think that in a work expressly designed for amateur use, hundredths of a second are out of place. Tenths of a second are, we think, the extreme limit, if not beyond the limit to which it is possible to go, without all the accessories of a fixed observatory. Secondly, we think that the value for the sun's semi-diameter should be given for every day alongside of, and to the same degree of precision as, the time of the transit of the sun's centre. These, however, are small matters, and on the whole we regard Mr. Latimer Clark as a zealous and able guide towards the universal spreading of true time.

Still, there is much yet remaining to be done; (1) we want some low-priced apparatus that shall give time accurately either from the sun, or preferably from both sun and stars; and (2) we want a clock which shall go within one minute per month, and which also shall be moderate in price. Heretical as horologists will consider the remark, we do not believe that the delicacy of the train or the perfection of the escapement is of much importance. Stout wheels reasonably well made, and an ordinary escapement connected with a well-varnished wooden pendulum, will, we believe, do all that is needed. It seems to us strange if this cannot be provided for £5.

GREENWICH OBSERVATORY.

WE are not aware that the portions of the Report of the Astronomer Royal which relate to Meteorology call for special comment, excepting the three which, for convenience of reference, we have numbered respectively 1, 3, and 6, in the following reprint.

As regards paragraph 1, we are glad to find that the anemometer is being sharply looked after—a thorough examination of the records of great pressures at Greenwich, with regard to the various modifications made in the instrument, would be both of scientific and legal value.

Paragraph 3 seems to prove that the opinion which we have long held, that the area appropriated to temperature observations has been unduly contracted, is correct. We regret to find that what is known as the South ground (to which we should have been glad to see some of the buildings now surrounding the thermometers removed), is now appropriated to an additional telescope. It is a great pity that the ab-

solute integrity of the open space around the thermometer-stand was not respected years ago.

Paragraph 6 indicates a change obviously desirable.

On the whole, we are glad to believe that Mr. Christie recognizes the importance of rigorous continuity and unaltered conditions in the Meteorological Department of the National Observatory.

1. The meteorological instruments and the Thomson electrometer are all in good order. A flexible brass chain has been substituted for the stiff copper wire connecting the pressure plate of Osler's anemometer with the recording pencil. The smaller pressures of ½ lb. and less are now very satisfactorily registered, and as regards the larger pressures, the records hitherto obtained throw some doubt on the results with the copper wire. On the occasion of the gale of 1882 October 24, a velocity of 64 miles an hour was registered with Robinson's anemometer for two successive hours, being greater than any velocity previously recorded here, but the greatest pressure registered with the chain was only 29 lbs. on the square foot, whilst on 1882 April 29 a pressure of 49½ lbs. was recorded with the copper wire, at a time when the velocity was only 50 miles an hour. The stiffness of the copper wire would appear to have exaggerated some of the largest pressures, and to have prevented the record of any of the very small pressures. The pressure scale on the paper was redetermined after the application of the brass chain, and was found to be almost precisely the same as before for large pressures. There were, however, some little differences in the portion of the scale applying to small pressures.

2. The observations of temperature of the Thames have recently been resumed under the charge of the Corporation of London, who have instructed Mr. G. J. Symons to arrange details. The observations are now made at the end of one of the jetties of the Foreign Cattle Market at Deptford, where a record is to be kept (by means of two Six's thermometers) of the daily maximum and minimum temperatures of the Thames at a depth of two feet below the surface, and also near the botton of the river. Mr. Symons has arranged that these observations shall be regularly communicated to the Royal Observatory, to be included in the meteorological table published weekly in the Registrar General's Reports.

3. Comparisons have been made during the past year between the readings of the two pairs of maximum and minimum radiation thermometers when exposed in the Magnetic Ground and South Ground respectively, and also when exposed side by side in the Magnetic Ground (for determination of the differences in their index errors). The general result of these observations is that the solar radiation temperature is somewhat higher in the Magnetic Ground than in the South Ground, and that there is little difference between the terrestrial radiation temperatures in the two situations, though, on the whole, the lowest temperatures are registered in the Magnetic Ground.

4. The mean temperature of the year 1882 was 49°·6, being 0°·1 lower than the average. The highest air temperature was 81°·0 on August 6, and the lowest 22°·2 on December 11. The mean monthly temperature was above the average from January to May, then below until September. In October, November, and December it differed little from the average.

5. The mean daily motion of the air in 1882 was 306 miles, being 27 miles greater than the average. For the month of November the mean daily motion was 449 miles, being 159 miles above the average. The greatest daily motion was 758 miles on November 4, and the least 30 miles on December 11. As already mentioned the greatest hourly velocity was 64 miles an hour, and the greatest pressure (with the chain) 29 lbs. on October 24.

6. During the year 1882 Osler's anemometer showed an excess of 11 revolutions of the vane in the positive direction N., E., S., W., N., if all the turnings are counted (as has been the practice in former years); or of 23 revolutions in the positive direction if the turnings which are evidently accidental are excluded.

7. The number of hours of bright sunshine recorded by Campbell's sunshine

instrument during 1882 was 1245, which is more than 40 hours above the average of the five preceding years.

8. The rainfall in 1882 was 25·2 inches, being very slightly above the average.

9. Certain particulars in regard to the effect of the change in the barometer or thermometer in the course of each month on the monthly values of diurnal inequality as given in the 20 years' Meteorological Reductions have been supplied to Gen. Strachey. Tracings of the Osler anemometer records from 1882 September 1 to November 24 have been made for Mr. G. J. Symons.

10. In regard to the coming year, I may mention one special work of meteorological reductions which it seems desirable to take in hand. The hourly ordinates of barometer and thermometer registers have been read out and tables of mean values formed for the 20 years of the Meteorological Reductions, and also year by year since 1877; but there is a gap of three years for the barometer (1874—1876), and of eight years for the thermometers (1869—1876), for which the photographs have not been discussed. The continuity of the Greenwich series is thus broken, and the results are not available to their full extent. The discussion which I contemplate for the years in question would probably occupy one computer for a year and a half, involving an outlay of about £70.

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday evening, the 16th inst., at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S. president, in the chair. F. A. Bellamy, T. A. Mercer, Rev. H. J. Poole, and A. Wise, M.D., were elected Fellows of the Society. The following papers were read:—

1. "Composite portraiture, adapted to the reduction of meteorological and other similar observations," by G. M. Whipple, B.Sc., F.R.A.S. It has often been remarked that one of the main, if not the chief, of the difficulties the meteorologist has to contend with, is the enormous amount of preliminary labour which has to be expended in the not very pleasing task of forming the observations he may wish to discuss into tables, casting the columns of figures so obtained, and then computing the means. With a view of arriving at results by a shorter cut, the author has been led to consider the possibility of employing a method suggested by a consideration of the highly ingenious system of composite portraiture, invented by Mr. Francis Galton, F.R.S., and utilized in his anthropological studies.

2. "Note on Atmospheric Pressure during the Fall of Rain," by H. Sowerby Wallis, F.M.S. The author discusses the condition of atmospheric pressure while rain was falling during 1882, and finds that out of a total of 136 rainy days (which were available for his purpose), on 54 per cent. the rain was accompanied by diminishing pressure, on 27 per cent. by increasing pressure, and on 19 per cent. by steady pressure.

3. "New Method of Reading a Thermometer and Hygrometer at a distance by means of Electricity," by Arthur W. Waters, F.G.S.

4. "An Integrating Anemometer," by W. F. Stanley, F.M.S.

5. "Observations on the Force of the Wind at Sea," by D. W. Barker, F.M.S.

6. "Meteorological Observations at Zanzibar, East Coast of Africa, during 1880 and 1881," by Surgeon-Major C. T. Peters, M.B.

7. "Diurnal Rainfall at Bangkok, Siam," by Capt. G. H. Inskip, F.R.G.S.

RAINFALL OF UBERABA, BRAZIL.

IT is not very often that we quote fragmentary records of foreign rainfall, for if we did, we should soon have our pages filled with nothing else. Moreover, it is far better for the government of each country to publish uniformly all the accurate data obtainable, because then one knows (1) that there is little probability of obtaining any records, unless they are found in the official volume; (2) that observations published therein may be considered as trustworthy.

We do not remember to have seen any such collection of returns for Brazil, and we believe that very few rainfall observations have been made in the interior of that vast country. Therefore, having found in the new American journal, *Science*,* the following returns, we make an exception in their favour.

Uberaba is in the Province of Minas Geraes, in the great watershed of the Paraná, on the high grassy land which divides the basin of the Paraná proper, from that of its great affluent the Rio Grande. Uberaba is in about long. 49° W., lat. 19° S., and its altitude is about 2,500 feet.

The observations were made by Friar Germano.

No information is given as to the position or height of the rain gauge.

	1880.	1881.	1882.
	in.	in.	in.
January	14·17	11·22	11·02
February	13·11	8·90	15·95
March	4·29	5·43	7·09
April	7·13	1·06	4·73
May	·75	·59	2·36
June	·08	·12	2·76
July	·43	·16	1·02
August	·08	·23	3·15
September	2·76	·47	3·82
October	7·48	4·02	4·72
November	10·79	5·59	3·94
December	8·62	11·42	4·92
Total	69·69	49·21	65·48

* [Published weekly at Boston, Mass,, and well worthy of support on both sides of the Atlantic.—ED.]

SUPPLEMENTARY TABLE OF RAINFALL,

MAY, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	2·13	XI.	Llanfrechfa Grange	1·85
,,	Margate, Birchington...	...	,,	Llandovery	2·27
,,	Littlehampton	2·43	,,	Solva	1·28
,,	St. Leonards	2·64	,,	Castle Malgwyn	1·67
,,	Hailsham	3·02	,,	Rhayader, Nantgwillt..	2·18
,,	I. of W., St. Lawrence.	2·54	,,	Carno, Tybrith	1·55
,,	Alton, Ashdell.....	1·74	,,	Corwen, Rhug	1·36
III.	Winslow, Addington ...	1·65	,,	Port Madoc	2·16
,,	Oxford, Magdalen Col...	1·94	,,	I. of Man, Douglas	...
,,	Northampton	1·53	XII.	Carsphairn	3·47
,,	Cambridge, Beech Ho...	1·08	,,	Melrose, Abbey Gate...	1·26
IV.	Southend	1·92	XIII.	N. Esk Res. [Penicuick]	1·35
,,	Harlow, Sheering	1·47	XIV.	Ayr, Cassillis House ..	1·87
,,	Diss	1·43	,,	Glasgow, Queen's Park.	2·03
,,	Swaffham	1·27	XV.	Islay, Gruinart School..	2·89
,,	Hindringham	1·61	XVI.	St.Andrews,NewtonBk.	·73
V.	Salisbury, Alderbury...	1·83	,,	Aberfeldy H.R.S.	1·15
,,	Warminster	2·42	,,	Dalnaspidal	3·69
,,	Calne, Compton Bassett	2·06	XVII.	Keith H.R.S.	2·95
,,	Beaminster Vicarage ...	1·79	XVIII.	Forres H.R.S.	·87
,,	Ashburton, Holne Vic..	2·56	,,	Strome Ferry H.R.S....	3·25
,,	Torrington, Langtree W.	1·92	,,	Lochbroom	3·74
,,	Lynmouth, Glenthorne.	1·26	,,	Tain, Springfield.....	1·41
,,	Probus, Lamellyn	2·33	,,	Loch Shiel, Glenaladale	...
,,	Taunton, Fullands	1·05	XIX.	Lairg H.R.S.	1·57
VI.	Bristol, Clifton	1·58	,,	Forsinard H.R.S.	4·12
,,	Ross	1·72	,,	Watten H.R.S.	2·45
,,	Wem, Sansaw Hall.....	1·73	XX.	Fermoy, Glenville	1·97
,,	Cheadle, The Heath Ho.	·93	,,	Tralee, Castlemorris ...	2·87
,,	Worcester, Diglis Lock	1·09	,,	Tipperary, Henry Street	1·48
,,	Coventry, Coundon	1·79	,,	Newcastle West	2·65
VII.	Melton, Coston	1·92	,,	Kilrush	...
,,	Ketton Hall [Stamford]	2·21	,,	Corofin	2·79
,,	Horncastle, Bucknall ...	1·79	XXI.	Carlow, Browne's Hill..	2·57
,,	Mansfield, Market Place	1·98	,,	Navan, Balrath	2·23
VIII.	Macclesfield, The Park.	1·05	,,	Athlone, Twyford	3·13
,,	Walton-on-the-Hill.....	·69	XXII.	Mullingar, Belvedere ...	2·08
,,	Lancaster, South Road.	1·26	,,	Clifden, Kylemore	4·80
,,	Broughton-in-Furness ..	...	,,	Crossmolina, Enniscoe..	3·09
IX.	Wakefield, Stanley Vic.	1·14	XXIII.	Carrick-on-Shannon ...	2·89
,,	Ripon, Mickley	1·38	,,	Dowra	...
,,	Scarborough.....	1·71	,,	Rockcorry.....	1·48
,,	East Layton[Darlington]	1·56	,,	Warrenpoint	2·22
,,	Middleton, Mickleton ..	1·29	,,	Newtownards	1·90
X.	Haltwhistle, Unthank..	1·44	,,	Belfast, New Barnsley .	2·55
,,	Shap, Copy Hill	2·95	,,	Bushmills	3·39
			,,	Buncrana	2·15

MAY, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·97	+ ·05	·60	11	11	79·6	24	31·0	4	2	3
II.		Maidstone (Hunton Court)...	1·96	— ·06	·80	26	9	...	...	...	...	..	...
,,		Strathfield Turgiss	1·83	— ·15	·56	26	11	76·4	25	29·2	3	2	5
III.		Hitchin	1·73	— ·26	·55	26	10	73·0	25	27·0	3	2	...
,,		Banbury	1·62	— ·51	·34	26	15	76·0	24	28·0	4	2	...
IV.		Bury St. Edmunds (Culford)	1·18	— ·72	·39	26	10	85·0	24	27·0	4	2	..
,,		Norwich (Cossey)	1·05	— ·76	·25	26	10	82·0	24	32·0	4	1	1
V.		Bridport	1·69	...	·73	11	9	...	..	...	...	...	...
,,		Barnstaple.....	1·59	— ·51	·53	11	12	75·0	23	...	...	...	..
,,		Bodmin	2·19	— ·65	·68	11	14	73·0	19	32·0	8	1	6
VI.		Cirencester	1·55	— ·63	·41	25	9	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	1·75	— ·64	·35	25	15	71·0	22	28·0	4	3	7
,,		Tenbury (Orleton)	1·20	— 1·23	·31	25	15	76·7	23	30·5	4	2	4
VII.		Leicester	2·26	...	·60	4	12	76·8	24	31·6	5	2	9
,,		Boston	2·48	+ ·71	·80	4	9	82·0	24	33·0	4	0	...
,,		Grimsby (Killingholme).....	1·76	+ ·11	·34	8	13	74·0	24	32·0	5	1	...
,,		Hesley Hall [Tickhill].....	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	·95	— 1·28	·25	12	10	75·0	25	35·0	4,5	0	...
IX.		Wetherby (Ribston Hall) ...	1·29	— ·53	·28	11	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	1·61	— 1·51	·47	7	14	72·0	16	32·0	11	1	...
X.		North Shields	1·72	— ·13	·49	7	12	74·2	24	31·0	7	1	1
,,		Borrowdale (Seathwaite).....	6·44	— ·54	2·68	28	12	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·01	— ·59	·78	11	10	...	...	...	...	...	...
,,		Haverfordwest	2·04	— ·65	·80	12	11	69·0	16	31·9	3	1	8
,,		Plinlimmon (Cwmsymlog) ...	2·39	...	·46	28	10	...	...	...	..	...	...
,,		Llandudno.....	1·42	— ·20	·53	8	6	65·3	25	38·5	9	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	1·97	— ·56	1·09	28	7	67·0	16	29·8	5	3	...
,,		Hawick	1·87	— ·27	·83	28	9	...	...	..	...	..	...
XIV.		Douglas Castle (Newmains)	1·63	— ·71	·68	28	11	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	...	...	...	...	...	...	...	...	...	...	...
,,		Appin (Airds)	3·42	...	...	..	...	...	...	..	...	...	.
,,		Mull (Quinish).....	3·20	...	·66	27	21	...	...	...	..	...	...
XVI.		Loch Leven Sluices	1·70	— ·59	·70	29	7	...	...	...	...	...	...
,,		Arbroath	1·35	— ·42	·22	25	11	67·0	24	33·0	6	0	...
XVII.		Braemar	1·85	— ·57	·26	31	20	64·8	23	31·0	8,9	5	20
,,		Aberdeen	·94	...	·13	25	18	73·0	24	32·0	5	1	...
XVIII		Skye (Sligachan)	10·89	...	2·50	28	17	...	...	...	...	...	...
,,		Culloden	1.22	— ·55	·40	31	5	66·0	25	33·8	4	0	10
XIX.		Dunrobin	2·14	...	·70	10	17	64·7	30	30·0	8	1	...
,,		Orkney (Sandwick)	2·94	+ 1·07	1·27	10	21	62·9	25	31·8	8	1	5
XX.	IRELAND.	Cork (Blackrock)	1·49	— ·67	·33	11	15	82·0	23	35·0	8, 10	0	...
,,		Dromore Castle	4·13	...	·80	28	12	71·0	16	33·0	8	0	...
,,		Waterford (Brook Lodge) ...	2·34	...	·62	7	13	70·7	17	32·0	11	1	...
,,		Killaloe	4·41	...	1·09	8	15	75·0	21	32·0	6,9	2	...
XXI.		Portarlington	1·99	+ ·14	·71	28	13	69·5	23	31·0	9	3	...
,,		Dublin (FitzWilliam Square)	2·02	+ ·30	1·39	8	13	68·8	23	35·4	11	0	0
XXII.		Ballinasloe	2·32	— .09	·58	25	15	64·0	16	31·0	10	1	...
XXIII.		Waringstown	1·62	— ·49	·41	28	14	72·0	22	30·0	9	3	6
,,		Londonderry (Creggan Res.).	2·31	...	·63	25	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·67	— ·68	·52	25	24	66·0	27	31·0	9	1	3

+ Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON MAY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather of the month was perfect, and all growing crops improved in appearance; apple in flower on 1st, horse chestnut on 18th; elm in leaf on 6th, oak on 10th, ash on 16th; T on 25th.

BANBURY.—Very cold for the first 11 days, afterwards pleasant, and very favourable for field and garden; mean temp. 51°·1, rather below the average; high wind on 1st, 6th, and 12th; S on 4th, 5th, and 11th; T on 11th and 25th.

COSSEY.—The first 12 days were cold with E. or N.E. wind, after which the weather was warm and forcing; the 24th was very hot and dry, at 3 p.m. the dry bulb reading 80° and the wet 64°.

BODMIN.—A very genial month, and vegetation made wonderful progress; mean temp. 54°·4.

CIRENCESTER.—A dry month, with pleasant weather at the end.

WOOLSTASTON.—Mean temp. of the month, 50°·4. S on 4th and 5th.

ORLETON.—The first twelve days were cold, with a mean temp. about 5° below the average, and frosts on several nights; frequent light falls of R occurred, and a little S fell on 3rd. The remainder of the month was warm and pleasant, with much clear sunshine and temp. above the average. Mean temp. of the month about half a degree below the average; rainfall less than half the average. T and L on 26th.

LEICESTER.—The early part of the month was unsettled, with frequent rains sometimes heavy, but from the 12th to the end was very fine and seasonable, sometimes hot; a very refreshing rain occurred on 25th and 26th, and at the end of the month the country was looking very green and promising.

KILLINGHOLME.—The beginning of the month was cold and wet, the latter part dry and warm, and at the close showers were wanted for grass and spring corn. Distant T and L on 25th.

MANCHESTER.—A very fine dry month, but owing to the prevalence of E. wind the temp. was rather low for the season, especially in the early part. TS on 25th.

WALES.

HAVERFORDWEST.—Until the 7th cold bleak weather prevailed, with N.E. winds and low night temp., although only on one night did the temp. fall below 32°; from the 7th to the 12th the weather was wet, which did wonders for the grass and corn, and the remainder of the month was fine and bright, at times warm, with a fine dry bracing air. The whitethorn was in blossom as early as the 20th, a very unusual occurrence; the oak was in leaf before the ash. A friend of mine tells me that about the 27th the N. Wales highlands were to be seen from Fishguard and continued visible more than 48 hours, which is considered a certain indication of long drought. It was notably the case in 1859, when only 3·25 in. of R fell between April 8th and August 5th.

LLANDUDNO.—The mean temp was 2° below the average, and the range both diurnal and total was somewhat large; mean humidity about the average; duration of bright sunshine 214 hours; rain much wanted at the close of the month.

SCOTLAND.

CARGEN.—The first half of the month was unusually cold, with prevailing E. and N.E. winds, the latter half was milder, and vegetation, which had been unusually backward, made great progress; mean temp, 48°·9, 2°·1 below the average. The oak and ash came into leaf almost simultaneously towards the end of the month, an unusual occurrence, the oak being generally much the earlier.

HAWICK.—From the 2nd to the 11th the hills were white with S, and cold E. winds prevailed. Apple and pear trees are literally covered with blossom, and though vegetation was much retarded by the cold weather, the copious R on 27th and 28th made the country look most promising.

QUINISH.—A cold, ungenial month throughout.

ABERDEEN.—The weather was dry and breezy throughout the month, for although R fell on 18 days the quantity at any time was not great, and the total fall is about an inch below the average; S on 2nd and 8th.

SLIGACHAN.—The first ten days of the month were very cold and dry, and vegetation made little progress up to the middle of the month; very heavy R occurred on the night of the 27th, when 2·50 in. fell between 1 a.m and 8 a m.

SANDWICK.—May is generally our driest month, but it was not so this year, the total R being much above the average, and the fall on 10th (1·27 in.) such as seldom occurs here. The first part was rather cold, but the latter part became mild and sunny, so that vegetation made great progress.

IRELAND.

DROMORE CASTLE.—Cold nights hindered vegetation during the first half of the month, but during the last fortnight the temp. was high and equable, and the growth of all crops rapid.

WATERFORD.—S. to W. winds prevailed during the last ten days of the month; L and H on 2nd; T on 2nd, 25th and 26th; S on the Comeragh Mountains on 10th.

KILLALOE.—S began to fall on the night of the 8th, and continued without intermission until 2 p.m. on 9th, the entire surface of the ground being covered until late on the 10th; such a mid-winter visitation in May was never experienced here before.

DUBLIN.—Although a spell of severe cold for the time of year occurred early in the month, it was on the whole favourable from every point of view. There was an average mean temp. and rainfall, while the number of rainy days was slightly less than the average. In Dublin L was seen on 5th; solar halos on 4th, 18th, and 22nd; sleet and S fell on 8th; H on 3rd, 4th, and 5th; fogs occurred on 16th, 17th, and 22nd.

WARINGSTOWN.—The weather was cold for the first ten days, then genial, especially in the latter part; great promise of fruit, and everything making rapid progress.

EDENFEL.—The harsh character of the first half of the month was compensated by the copious showers and warm sunshine of the latter half. Vegetation at the end of the month was most luxuriant.

FRANCE AND TONQUIN.

WE are very glad to be able to announce that among the medical officers selected by the French Government to proceed with the expedition to Tonquin was Dr. Borius. Our readers will doubtless remember that we have been able to mention with considerable approval several works by Dr. Borius, the earlier ones on the climate of Senegal and other parts of tropical Western Africa, the later ones on that of Brest.

Dr. Borius received from the Bureau Central de Météorologie a good equipment of instruments, including recording barometer and thermometer, and sailed from Marseilles on the 29th of May.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCX.] JULY, 1883. [PRICE FOURPENCE, or 5s. per ann., post free.

A "LIGHTNING FIGURE" PHOTOGRAPHED.

THAT the possession and care of a large library is a tax upon one's time and purse, nobody will deny, but on the whole it is a less evil than to be without the books you want, as I am at this moment uncomfortably convinced. How, I will presently explain.

At a meeting of the Meteorological Society, held March 24th, 1857, Prof. Poëy read a paper entitled "On the connection of photographic impressions with those of the images which lightning produces on the surface of the human body." A short abstract of the paper is printed in the Annual Report of the Meteorological Society for 1857, and from it I quote the first two cases of the seven there given.

1. The first authentic, but not the earliest, mention of this singular phenomenon, was made by Benjamin Franklin in 1786, who himself stated to a member of the French Academy, M. Leroy, that, twenty years previous, a man, who was standing opposite to a tree which had just been struck by lightning, was very much surprised to perceive on his breast a *fac-simile* of that *tree*.

A similar case was pointed out in the "Journal of Commerce" of New York, on the 26th of August, 1853, which gives the following account:—"A writer in the 'Intelligencer' communicates a curious incident. A little girl was standing at a window, before which was a young maple tree. After a brilliant flash of lightning, a *complete image of the tree* was found imprinted on her body. This is not the *first* instance of the kind."

The Report of the Society goes on to state:—

Shortly after the reading of M. Poëy's paper before the Society, the following communication was addressed to C. V. Walker, Esq., Member of the Council.

"On the Photographic Effects of Lightning," by James B. Shaw, Esq.

"I beg to give you the particulars connected with the photographic effects of lightning on six sheep, which were killed by a stroke of electricity about the year 1812.

"About four miles from the city of Bath, near the village of Coombe Hay, was at that time an extensive wood of hazel and detached oak-trees. In the centre of this wood was a field of about 50 yards square, in which were six

sheep, all of which were struck dead by lightning. When the skins were taken from the animals, a *fac-simile* of a portion of the surrounding scenery was visible on the inner surface of each skin. I do not remember whether these six beautiful photographic images were precisely similar, but I think they were.

"I remember that it caused great local sensation at the time, and the skins were exhibited in Bath, and I have no doubt there are many living now in that neighbourhood who could vouch for the correctness of this statement. I may add, that the small field and its surrounding wood were so familiar to me and my schoolfellows, that when the skins were shown to us, we at once identified the local scenery so wonderfully represented. I was much pleased to read the several cases mentioned before the Meteorological Society, proving the photographic effects of lightning on animals, as my statement of the circumstances herein described, frequently detailed by me, has always been received with credulity." [? incredulity—Ed.]

In 1861, Prof Poëy published an extremely fascinating memoir upon the subject.*

In the same year, and in 1862 Prof. Tomlinson, F.R.S., of King's College, published two papers in the *Edinburgh Philosophical Journal* on "Lightning Figures," in which he maintained that there was no photographic action whatever, but that the ramifications of the electric fluid, such as occur on deflagrating a sheet of gold leaf, had been erroneously identified with the branches of trees. I can deal only generally with this argument, because, on the completion of the Report of the Lightning Rod Conference, I forwarded Prof. Tomlinson's papers, and most of my pamphlets and books upon Lightning to the Society of Telegraph Engineers, thinking that I had done with the subject, and feeling, as I still feel, that copies of them ought to be in that splendid electrical library. Hence my opening complaint respecting the absence of books which I want.

A week or two since I was delighted to see the following letter in the *English Mechanic* :—

THUNDERSTORM AT DUNSE, BERWICKSHIRE, N.B.,
AND
SINGULAR PHENOMENON CONNECTED WITH IT.

On Saturday, the 9th of this month (June), about eleven o'clock a.m., a thunderstorm broke over the town, accompanied with a very heavy fall of rain. Four boys, each about 10 years of age, were overtaken by this storm about half a mile to the south-east of the town. Their nearest place for shelter was Cairnbank, and this place they reached, but not before each of them was thoroughly drenched with the rain. They entered the doorway of the stable, being the nearest house, but had scarce entered it when the lightning broke on a yew-tree at the back of the stable. Part of a wall near to the stable was also thrown down. The stable has a window at the back, and also another doorway at the end ; and when the yew-tree was struck one of the boys was thrown across the road, whilst the other

* Relation Historique et theorie des images Photo-Electriques de la Foudre. 2nd Ed. 12mo. Paris, 1861.

three were all thrown down. One of the residents at Cairnbank witnessed from her window the boy thrown across the road, and she, along with her husband, came to his rescue, when they also discovered the other three boys prostrate in the stable. They were carried into the house. One of the boys had got such a shock in his arms that he asked if they were off. His jacket was removed to see if there was any visible cause of the pain he seemed to suffer, when it was found that the impression of the yew-tree branches was as distinct on his arms and body as if there had been a prepared surface and struck off in the camera. Each of the boys presented more or less similar appearances. During the course of two days the appearances had all left their skin, and all the boys have fully recovered. A photograph was taken of the boy with the largest impression; and although not before it had begun to fade, still it is distinct enough to preserve a record of this wonderful phenomenon. Can any of your scientific readers offer an explanation?

We may state that on rehearsing the details to a friend, a day or two after it occurred, he gave it as a fact that sheep struck and killed during a thunderstorm, when the skin was removed, had the impression of the surrounding landscape distinctly left, which impression must have been struck through the outer skin.

The impression of the yew-tree branches which was so distinct had been struck through a cloth jacket and shirt as well, and this circumstance makes it the more wonderful.

Dunse, N.B. JOHN WILLIAMSON.

I immediately wrote to Mr. Williamson, and asked him to favour me by obtaining a copy of the photograph. He has not only done so but has also sent me a letter from Mr. Bruce who took the photograph, which, in spite of its length, I consider well worthy of reproduction.

LIGHTNING PRINTS ON BOYS.

To the Editor of the Berwickshire News.

"SIR,—It may be interesting to some of the readers of the *News* to know that, through the thoughtfulness of Mr. Gunn, chemist, I secured a well-defined impression of the 'lightning print' found on the arm of his son, George Gunn, who, along with other three boys, was, as reported in your last issue, struck by the electric fluid. So far as I am aware, it would seem that this is the first time this remarkable phenomenon has been photographed, and, perhaps, when the picture is put into the hands of one of our eminent electricians the photographic image may elucidate a point which is, at present, in the minds of many people rather hazy. In relating the miraculous escape those four boys made from a violent death, your correspondent, while suggesting the popular idea, that the delicately-traced figures, so very like fern fronds, or branches of trees, are caused by the object, which happens to be near the person struck by lightning, being printed on the surface of the body, does not identify himself with this theory. He only suggests the current idea, that the marks found on the necks and arms of the boys, may be representations of a tree not far distant from where they were standing. Now, while it is not to be wondered at that for generations this has been believed, I, for one, am not prepared to accept the

current belief as scientifically correct. The first objection which presents itself to my mind against the generally accepted opinion, that the floral figures impressed upon the skin are photographic representations of surrounding objects, is, that the photographic conditions necessary to form the image and retain it are entirely wanting, namely, a lens and a surface made sensitive to light. But, assuming that a law exists, unknown to us, by which the electric fluid in passing from a thunder-cloud to the earth so rarefies the air, that, as in the case of the mirage, the atmosphere, by the laws of reflection and refraction, depicts objects as clearly as a photographic lens; and further, that for the time being the surface of the human body is so affected as to become sensitive to light, and thus prepared to receive and retain impressions of surrounding scenery, the 'lightning prints' under these circumstances, would be, I think, different from what we find they really are. The floral figures which were so vividly represented on the bodies of the boys, were, what may be called, positive pictures, namely, a *dark* picture on a *white* ground; whereas, had they been formed by the chemical and optical laws that are essential to the formation of the photographic shadow of a tree, they would have been negative pictures—that is a *white* picture on a *dark* ground. There are other objections that might be mentioned, such as the position of the tree referred to by your correspondent in relation to the boys who were *within* the stable, and also, that while the 'lightning prints' were clearly defined, there were no impressions visible from the clothes they wore. I think, however, that sufficient has been said to show that we must search in some other direction for the cause of these mysterious and delicately beautiful forms, and, thanks to the researches and experiments of scientists, the probable explanation is not far to seek. by a simple experiment, a stream of sparks discharged from an electrical machine, can be broken up and made to take the exact form of figure found on the arm photographed. Or if a charged *Leyden jar* be substituted in our experiment, and a pane of glass be interposed between the knob of the vessel and the discharging tongs, a perfect *breath figure* of the discharge is seen on each side of the glass which bears a most striking resemblance to a tree. Knowing, then, that under certain conditions the sparks from an electric machine may be made to take the form of a brush, a feather, a fern, or a tree; we are, I venture to say, compelled to come to the conclusion that the markings developed on the necks and arms of our young friends were caused by the direct action of the electric fluid, paralyzing the nervous system, and causing, for a time, congestion in the capillary vessels, and therefore redness, wherever the tree-like sparks touched the skin.—I am, &c.,

GEORGE BRUCE.

Dunse, 15th June, 1883."

Those interested in the subject should send to Mr. Bruce, Dunse, Berwickshire, for a copy of the photograph, and I think that they will agree with me that the markings are not referable either to the yew tree or to photographic action, but simply to the well-known ramification of an electric discharge.

Whether my opinion be right or wrong is immaterial; the great fact is, that at last we have a beautiful photograph of the appearance which has been a bone of contention for half-a-century.

G. J. SYMONS.

EXTRAORDINARY HAIL-STORM AT BARTON, NORTH LINCOLNSHIRE.

ON Tuesday night, July 3rd, between 10 and 10.20 p.m., this town and immediate locality was visited by a storm of thunder, lightning, and hail of tropical severity. Never within the memory of the oft-quoted "oldest inhabitant" has such havoc been made by hail. Scarcely a pane of glass on the south-east aspect of any house in the town but is either smashed or cracked, and greenhouses and garden glass generally may be said to be utterly demolished. The size of the hailstones was enormous, and of every conceivable shape, weighing from ¼ ounce to 2 ounces, and some measuring 6 in. in circumference. Superintendent Ward picked up a piece of ice 2½ in. long, 2 in. wide, and 1 in. deep. In some cases the loss is estimated at hundreds of pounds. It was not only ordinary glass which was smashed, but thick heavy 3-16ths plate was unable to resist the impetuous rush of hail, and even the ¼ in. thick glass roof of the Drill Hall was broken. At Mr. Alexander Swanson's Mount Pleasant Nursery, over 2,000 ft. of conservatory and other glass was destroyed, and the fruit and flowers inside were much cut and injured. The hail-storm appears to have extended over a mile and a half in width, assuming a semi-circular form, commencing at Grimsby, along Pelham's Pillar, Wootton Grange (where the windows of Mr. Brooks' house were smashed, while no hail fell in the village itself); Burnham, Deepdale (where the Wesleyan Chapel windows were seriously damaged), to Barton, reaching The Grange on one hand, and Mr. Frank Bygott's farm on the other, so that Barrow and New Holland were exempt. It appears to have spent its force on the Lincolnshire side of the Humber, terminating at Barton Cliff, where the hail was comparatively small, while at the Marsh Farm no injury was done. In many of the fields of wheat and barley only an upstanding head is to be seen here and there, the straw being broken and the land strewed with heads; some of the fields of seeds which were waiting for the reaper look as though heavy rollers had passed over them. Mr. Stephenson, of The Beeches, was riding home, and had his hands severely bruised and his hat cut by the falling ice. The scenes of desolation next morning proved the intense severity of the storm. In the gardens and fields were many dead feathered songsters, and wild birds and ground game have been killed. As we before said, not a greenhouse or glass frame but is more or less smashed, and in some not a whole pane is left; grapes and flowers and cucumbers suffered very seriously, and the out-door fruit, such as pears, gooseberries, currants, and apples, lay on the ground by bushels, mixed up with broken branches and leaves. Many of the hailstones which fell at Barton were striated with opaque lines and had opaque cores, surrounded with a translucent covering, being frail but very beautiful objects. To give an idea of the quantity of ice which fell, it may be added that on the afternoon of the following day it lay in some of the field ditches 2 ft. deep.—Abridged from the *Hull and North Lincolnshire Times* of July 7th.

THE METEOROLOGICAL SOCIETY.

THE closing meeting of the present session was held on Wednesday evening, the 20th ult., at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair, when the following papers were read :—I, "On the Structure of the Ice-cloud

disposed in threads, proposed to be called Cirro-filum," by the Rev. W. Clement Ley, M.A. F.M.S. Of the Cirriform clouds one of the most important to the weather forecaster is that to which the author has given the name cirro-filum. Having from the time he was twelve years of age carefully studied this cloud whenever visible, and having for the last twenty-five years made it the subject of minute study, he is enabled to bring forward some results which may prove of value. The author gave, firstly, a short account of the mode in which he was led to prosecute this study; secondly, a classification of the more recent and reliable observations; and, lastly, an explanation of the principal phenomena observed. 2, "Notes on a Second Series of Experiments on the distribution of Pressure upon Flat surfaces perpendicularly exposed to the Wind," by Richard H. Curtis, F.M.S. The results obtained in these experiments agree very closely with those of the former experiments. 3, "On the Reduction of Wind Records," by the Hon. Ralph Abercromby, F.M.S. The author discussed the significance of, and the best method of deducing from anemographic records, the total quantity, the quantity from different points of the compass, the relative frequency, the mean hourly and annual velocity, the mean velocity from different quarters, the resultant, and the mean direction of the wind. 4, "The Spectroscope as an aid to Forecasting Weather," by F. W. Cory, M.R.C.S. F.M.S. 5, "Note on River temperatures as compared with Air temperatures at Greenwich and Bremen," by Robert H. Scott, M.A., F.R.S. The author compared the results given in a recent paper by Sir G. B. Airy on a comparison between the records of the temperature of the Thames and those of air temperature taken at Greenwich, with those published by Herr von Freeden for the temperature of the Weser, as compared with that of the air near Bremen, for the ten years 1858–67.

REVIEW.

Stanford's Compendium of Travel—North America. Edited by PROF. F. V. HAYDEN and PROF. A. R. C. SELWYN, F.R.S. 8vo. Stanford, xvi. 652 pages and 16 maps.

SOME years since we had the pleasure of noticing with warm approval the volume of this series which treated of Africa. The present is in all respects equal to it. Africa contained an entirely new idea in the formation of rain charts. North America contains a couple of maps which seems to us equally original. They are intended to show the areas of climatal extremes, and this they do as follows:—For extreme cold the data taken are (1) in the United States the mean temperature at 7.35 a.m. (Washington time) of the coldest week of 1872, and (2) for Canada the absolute minima during 1880.*

* It would, of course, have been better to have used identical data, both as to system and to epoch, but when the work was written synchronous data had not been published.

These values are indicated on the map by a series of tints running, in shades of blue for each 10°, from 60° down to zero, and then in three shades of black to —20°, beyond which the degrees are printed on the shading, for, as our readers are doubless aware —20° would quite fail to represent a Canadian minimum. The greatest cold is at a station in Lat. 56°, Lon. 119° W.; it is almost precisely in the same latitude as Edinburgh, and was evidently started by a Scotchman, for its name is Dunvegan, the same as our rainfall station in the West of Skye. But while the Scotch Dunvegan had a minimum of 16°·0, the Canadian Dunvegan had a minimum of —62°·4. Of the two stations Dunvegan in Skye is 95 miles nearer the North Pole than Dunvegan in Athabasca, and yet the minimum at the Canadian, is nearly 80° below that at the Scotch, station. It would probably be difficult to produce stronger evidence of the influence of the sea on the temperature of the West of Scotland.

This remarkable minimum has led us astray from the feature to which we desired to call attention. It is one of such importance that we scarcely think that its mention in a review is treating it with sufficient respect, but we cannot spare space for more elaborate notice.

The method of indicating pressure, temperature, rainfall, &c., by various colours laid upon maps, and by shaded maps, is now so common as to need no notice, but in the maps in this volume there is a most praiseworthy novelty. The following note appears in the corner of each map :—

"The tints cannot at present be extended over the Dominion of Canada, as the stations are so very few and far between."

This is perfectly true, and there is a tract in one part, without reckoning land more northerly than Edinburgh, where there are 450,000 square miles without a single station. We have on our table a very pretty looking map which runs its shaded tints all over this district, with what vividness of imagination, the facts we have just mentioned sufficiently prove. In Mr. Stanford's maps he has the pluck to recognise the absurdity of this proceeding. He inserts the notice we have just quoted, and puts small blocks of the appropriate tint over the sites for which he has data, thus giving one confidence in the districts which he has shaded, and pointing out those for which no information existed at the date of his maps. We add those last words because the Canadian system is being pushed steadily onwards, and every year sees some of the vast interstices filled up.

We have left ourselves no space for noticing Chapter VII., which treats of the climate and vegetation of British America, beyond saying that this long chapter (35 pages) contains the best general notice of Canadian climate which we have yet seen.

SOME COLONIAL RAINFALL NOTES.

RAINFALL IN 1882 AT WINDSOR FOREST PLANTATION, DEMERARA, BRITISH GUIANA.

Lat. 6°50′ N. Lon. 58°4′ W.

Rain gauge : Diameter of funnel, 5 in. ; height of top--above ground, 6ft. 6in. ; above sea level, 2½ ft.

1882. Month	Total Depth.	Greatest Fall in 24 Hours.		Number of days on which ·01 or more fell.
	inches.	Depth.	Date.	
January ...	8·62	2·24	9	23
February..	1·76	·54	21	7
March.....	6·87	1·86	14	11
April	11·20	4·21	3	12
May.....	18·39	2·50	29	23
June	13·08	2·23	2	22
July.....	8·46	1·49	26	18
August ...	5·69	1·34	7	14
September.	1·36	·60	10	5
October ...	5·24	3·65	7	6
November.	5·98	1·58	6	11
December .	10·90	1·63	10	23
Total ...	97·55			175

W. C. GRIFFITH.

[It seems almost as if there was a conspiracy to drive us from the resolution announced on page 76 of our last number, for within a month from its publication we have been favoured by the Rev. C. H. Griffith with copy of observations made by his son at a station on the opposite shore of the Demerara river to George Town, and about eight miles from that capital. We have seen no records from British Guiana since those made by Mr. Sandeman 1846–56, and published by the local government, and therefore the present records possess exceptional interest. We find that heavy falls in 24 hours are still the characteristic of the climate, for besides those quoted above, we find in Mr. W. C. Griffith's MS. falls in the previous year (1881) of 5·47 in. on May 1st ; 3·94 on May 19th ; 3·00 on November 27th ; and 6·47 in. on December 29th.

We have also been favoured by the Rev. S. Bridge with a copy of the daily record kept by his son at Ashcott, Hawke's Bay, New Zealand. As, however, there is for New Zealand a meteorological organization ably directed by Dr. Hector, F.R.S., it will be far better for Mr. Bridge to place himself in communication with Dr. Hector, if indeed he has not already done so. We notice that the Ashcott rainfall for 1882 was 47·63 in. ; our own Climatological Tables show that at Wellington it was 55·69 in., and at Auckland 45·44 in.—ED.]

EARTHQUAKES OF JUNE 25TH.

To the Editor of the Meteorological Magazine.

SIR,—You will perhaps be interested to know that yesterday there occurred a slight shock of what everyone believes to have been an earthquake.

I was on the point of rising from a chair after luncheon at 1.40 p.m., when there was a sound, *not like thunder*, but more like the rumble of a waggon on pavement under ground. The sideboard, a large one, shook, as also the wall and the pictures, and the floor of the room. The servants, at dinner, said that the earthenware on the table, and the table itself, shook, and also the kitchen stove. It was felt by people in almost every house in the neighbourhood for miles round, I am told, as far as from Budehaven to Okehampton, a distance of over 30 miles, and from Launceston to Holsworthy, 14 miles. In some places earthenware was shaken off the cupboards on which it was placed. As yet I hear of no injury of any kind. It was almost instantaneous, and followed by a clap of thunder about half an hour afterwards, but everyone is quite certain that the shaking of the walls, &c., was not occasioned by thunder. One man says he felt the earth on which he was standing out of doors shake, and a woman near this, in her garden, says she perceived the earth rise as it were.—Yours truly, WALTER WM. MELHUISH.

P.S.—In a shed, three miles distant, on the Bude Canal, where coals are kept for sale, the coals, which were piled up in a heap, fell.

Court Barn, near Holsworthy, Devon, 26th June, 1883.

To the Editor of the Meteorological Magazine.

SIR,—Two shocks were distinctly felt in this neighbourhood. I have fortunately been able to verify the exact time of the first shock, which may be assumed as 1h. 39m. p.m., correct within half-a-minute, at Kingsand, a village by the sea, one mile S.S.W. of Maker Church. I have not been able to verify the time of the second shock, but it was *after* 2.5.

So many accounts speak of a shock between 1.48 and 1.55 that I almost think there were three shocks in all. Very few persons felt *both* shocks here.

One invalid, lying in bed, who felt *both* shocks, describes the vibration of the *second* shock as much the more decided and continuous of the two.

A fisherman sitting on the ground thought that the earth was giving way beneath him, and sprang up in alarm at the second shock.

The usual rumbling sounds were heard, but were not particularly loud.

Unfortunately I heard and felt nothing myself, but the above statements are reliable.—Faithfully yours,

P. H. NEWNHAM.

Maker Vicarage, Devonport, June 27th, 1883.

[These are the only letters which we have received upon the subject. We add only two notes :—(1) As regards "True Time," we congratulate our correspondents upon their close agreement: one says 1.39 and the other 1.40; that looks as if observers were at last beginning to keep their clocks near the truth. (2) Mr. Newnham's letter greatly extends the area over which the shock was felt, and makes it more than 800 square miles.—ED.]

FICKLE JUNE.

To the Editor of the Meteorological Magazine.

SIR,—The following are the temperatures recorded here at 3 p.m. since this month set in, and the difference of each month from the preceding.

	Temp at 3 p.m. °	Difference. °
June 1	58	
,, 2	68	+10
,, 3	64	— 4
,, 4	61	— 3
,, 5	48	—13
,, 6	59	+11
,, 7	51	— 8
,, 8	58	+ 7
,, 9	70	+12
,, 10	52	—18
,, 11	59	+ 7
,, 12	61	+ 2
Average difference ...	8°·6.	

FENWICK W. STOW.

Aysgarth Vicarage.

TRUE TIME.

AN ANTIQUE ERRATUM.

A CORRESPONDENT has called our attention to the example reprinted on p. 71 of our last number. We are glad to say that our reprint is accurate, but the worthy Mr. S. Watson, or his printer, A.D. 1694, got in rather a muddle. We give the figures as

Mr. Watson intended to give them :—

	h.	m.	s.
Original state of clock...	9	3	4
Correction for 8 nights		31	27
What the clock *should have been* on eighth night	8	31	37
What the clock *was* on eighth night* ...	8	34	32
Gain of clock		2	55

* Once printed 8 34 42, and once 8 24 32.

We may also here mention the publication of the fourth edition of "The Watch and Clockmaker's Handbook," by F. J. Britten (Kent & Co). It is crammed full of information respecting clocks and watches, and we are sorry not to have been able to give it a line of praise before, but want of space and want of time shut out many notices, and when a book reaches its fourth edition its utility may be regarded as proved.

To the Editor of the Meteorological Magazine.

SIR,—In the last number of the *Meteorological Magazine*, is a paper on "True Time." For many years past I have resorted to several simple means for the attainment of this. Should you meet with the published volumes of the *English Mechanic*, you will find some of these methods described by me. The volumes are XIV., March 15th, 1872, p. 664. (N.B.—By mistake of printer, it should have been stated that the wood-cut is $\frac{1}{3}$ of *real* size of apparatus). Vol. XV., April 19th, 1872, p. 121. Vol. XV., Sept. 6th, 1872, p. 640. That which I have called "the wall transit" might, probably, be rendered an effective instrument by a professional optician. That which I have used is only the rude work of my own hands. The transit "lines" are at once simple, and, within certain limits, accurate—My additions to their original forms as described by Dr. Derham, will be found in the paper in the *English Mechanic*. I now use the Dipleidoscope. This, however, is a somewhat expensive instrument, and requires accurate adjustment, which few, perhaps, will undertake. The "spot meridian dial," described I think in "Denison on Clocks," is easily constructed—and, I presume, will, when read with a lens, give the time to a few seconds. Perhaps some of the above may be of service to the readers of the *Meteorological Magazine*.—Yours truly,

N. J. HEINEKEN.

Sidmouth, June 18th, 1883.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1883.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	55·3	1	28·8	24	46·3	36·9	37·7	87	73·9	24·5	2·07	21	7·4
Cape of Good Hope	..	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	84·3	24	72·5	2	82·9	75·2	69·7	75	...	...	7·44	19	7·6
Calcutta	80·5	27	48·4	20†	76·2	53·0	53·8	71	144·8	35·2	·07	2	1·7
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	87·1	17	62·0	29	83·5	69·0	63·8	65	140·6	53·4	·12	1	1·4
Ceylon (Colombo)	90·6	29	69·8	30	87·0	72·4	69·6	73	150·0	64·0	2·34	7	5·8
Melbourne	104·9	15	48·9	12	79·5	55·7	51·8	60	165·0	38·8	·42	5	4·5
Adelaide	109·5	15	49·2	2	88·3	61·4	48·6	40	171·5	40·6	·10	3	4·4
Wellington	80·3	27	48·0	30	72·6	56·7	...	...	148·0	46·0	2·02	3	...
Auckland	85·1	19	57·6	14	76·8	62·7	58·6	66	138·2	43·0	2·07	11	6·8
Falkland Isles	68 0	28	33·7	25	55·0	42·0	43·5	81	134·0	29·2	3·31	22	7·5
Jamaica (Kingston)	89·8	4	66·7	22	85·4	69·8	68·2	79	...	59·1	3·73	7	4·2
Barbados	80·0	var.	66·0	11	79·0	69·0	74·4	79	142·0	66·0	6·53	22	..
Toronto	40·5	30*	−7·8	23	25·1	9·4	16·2	84	108·0	−11·0	2·45	18	7·4
New Brunswick, S.John	40·0	21	−14·0	6	22·5	4·7	13·5	91	...	...	4·03	15	4·9
Cape Breton, Sydney	...	...	...	...	...	...	...	...	...	...	.	...	...
Manitoba, Winnipeg	14·7	12	−46·5	21	−5·4	−26·9	...	...	86·5	...	·64	12	4·8
British Columbia, Yale	46·5	9	−35·3	18	21·6	3·5	...	...	...	...	2·39	16	3·2

* And 31 † And 21.

REMARKS, JANUARY, 1883.

Mauritius.—Rainfall 1·45 in. above, and mean temp. 0°·2 below, the average; mean pressure, 29·921 in.; mean hourly velocity of wind 11·8 miles, extremes 29·2 miles, on 22nd, and 3·1 miles, on 21st, prevailing direction E. to N.E.; T and L on 21st, L on 26th and 31st. C. MELDRUM, F.R.S.

Ceylon.—TSS occurred on 26th and 27th.

Melbourne.—Mean pressure, and temp. of air, above the average, Mean temp. of dew point, amount of cloud, and humidity, all below the average; rainfall 1·23 in. below it. Prevailing direction of wind S. and S.W., strong breezes occurring on five days; hot wind on 15th; heavy dew on five days; L and distant T on 15th.
R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure slightly below the average of the previous 26 years; mean temp. nearly the same as the average; the max. reaching, or exceeding 90° on eleven days. On only two occasions have I registered a smaller rainfall during January.
C. TODD.

Wellington.—Very fine weather with variable winds up to the night of 10th, when R came on from N.W.; heavy R on 11th and 12th; from 12th to 28th splendid weather, though at times very warm with oppressive nights; remainder of month fine. Prevailing direction of wind N.W. R. B. GORE.

Auckland.—Bar. rather high; temp. also much above the average, wind mostly light; Weather principally very dry, but heavy R occurred on 24th, with N.E. wind.
E. B. DICKSON.

BARBADOS.—Mean temp. the same as the average; rainfall 38 per cent., and evaporation 41 per cent. above the average. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Rain.
		in.			in.
II.	Dorking, Abinger	1·61	XI.	Llanfrechfa Grange ...	1·92
,,	Margate, Birchington...	1·22	,,	Llandovery	5·72
,,	Littlehampton	1·45	,,	Solva	2·17
,,	St. Leonards	·87	,,	Castle Malgwyn	4·37
,,	Hailsham	1·15	,,	Rhayader, Nantgwillt..	4·50
,,	I. of W., St. Lawrence.	1·35	,,	Carno, Tybrith	4·21
,,	Alton, Ashdell.....	2·11	,,	Corwen, Rhug	3·18
III.	Winslow, Addington ...	2·48	,,	Port Madoc	3·43
,,	Oxford, Magdalen Col...	4·35	,,	I. of Man, Douglas	2·57
,,	Northampton	3·13	XII.	Carsphairn	2·32
,,	Cambridge, Beech Ho...	6·08	,,	Melrose, Abbey Gate ..	3·95
IV.	Southend	1·87	XIII.	N. Esk Res. [Penicuick]	2·65
,,	Harlow, Sheering	2·69	XIV.	Ayr, Cassillis House ...	3·14
,,	Diss	3·13	,,	Glasgow, Queen's Park.	2·54
,,	Swaffham	4·21	XV.	Islay, Gruinart School..	3·55
,,	Hindringham	4·25	XVI.	St.Andrews,NewtonBk	2·32
V.	Salisbury, Alderbury...	1·57	,,	Aberfeldy H.R.S.	1·67
,,	Warminster	2·48	,,	Dalnaspidal	3·16
,,	Calne, Compton Bassett	2·91	XVII.	Keith H.R.S.	1·71
,,	Beaminster Vicarage ..	4·26	XVIII.	Forres H.R.S.	·78
,,	Ashburton, Holne Vic .	4·47	,,	Strome Ferry H.R.S....	2·96
,,	Torrington, Langtree W	3·13	,,	Lochbroom	1·39
,,	Lynmouth, Glenthorne.	2·62	,,	Tain, Springfield.....	1·25
,,	Probus, Lamellyn	4·42	,,	Loch Shiel, Glenaladale	5·00
,,	Taunton, Fullands	1·73	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	3·11	,,	Forsinard H.R.S.	0·67
,,	Ross	4·30	,,	Watten H.R.S.	1·48
,,	Wem, Sansaw Hall.....	2·29	XX.	Fermoy, Glenville	2·00
,,	Cheadle, The Heath Ho.	3·91	,,	Tralee, Castlemorris ...	2·27
,,	Worcester, Diglis Lock	2·82	,,	Tipperary, Henry Street	1·40
,,	Coventry, Coundon	3·54	,,	Newcastle West	1·81
VII.	Melton, Coston	2·85	,,	Kilrush	...
,,	Ketton Hall [Stamford]	3·34	,,	Corofin	2·04
,,	Horncastle, Bucknall ...	4·06	XXI.	Carlow, Browne's Hill..	1·43
,,	Mansfield, St. John's St.	3·85	,,	Navan, Balrath	2·01
VIII.	Macclesfield, The Park.	4·36	,,	Athlone, Twyford	1·96
,,	Walton-on-the-Hill.....	2·38	XXII.	Mullingar, Belvedere ...	2·48
,,	Lancaster, South Road.	3·70	,,	Clifden, Kylemore	3·46
,,	Broughton-in-Furness ..	4·33	,,	Crossmolina, Enniscoe..	1·46
IX.	Wakefield, Stanley Vic.	3·54	,,	Carrick-on-Shannon ...	1·70
,,	Ripon, Mickley	3·34	XXIII.	Dowra	2·07
,,	Scarborough.....	2·67	,,	Rockcorry.....	2·30
,,	EastLayton[Darlington]	1·92	,,	Warrenpoint	1·77
,,	Middleton, Mickleton ..	2·42	,,	Newtownards	1·18
X.	Haltwhistle, Unthank..	3·10	,,	Belfast, New Barnsley .	1·93
,,	Shap, Copy Hill	4·27	,,	Bushmills	1·82
			,,	Buncrana	2·21

JUNE, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·35	— 1·32	·49	29	12	85·6	29	41·3	17	0	0
II.		Maidstone (Hunton Court)...	1·46	— ·61	·50	26	12	...	...	...	...	...	...
,,		Strathfield Turgiss	1·72	— ·38	·35	21	13	81·2	29	36·9	18	0	1
III.		Hitchin	2·08	— ·05	·52	15	12	77·0	29*a*	38·0	11	0	...
,,		Banbury	2·30	— ·14	·60	15	13	78·0	29*a*	37·0	17	0	...
IV.		Bury St. Edmunds (Culford)	2·08	— ·19	·76	15	12	87·0	29	37·0	11	0	..
,,		Norwich (Cossey)	2·73	+ ·51	·85	15	13	82·0	29*a*	39·0	1,9	0	0
V.		Bridport	3·05	...	·56	29	13	...	..	...	...	...	...
,,		Barnstaple.....	3·10	+ ·38	·49	24	16	77·0	4,5	48·0	24	0	..
,,		Bodmin	4·19	+ ·98	·86	27	19	74·0	4	42·0	23	0	0
VI.		Cirencester	4·82	+ 2·33	·91	27	15	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·71	— ·16	·58	15	17	72·5	30	40·5	6, 17	0	...
,,		Tenbury (Orleton)	2·75	+ ·01	·51	20	19	76·3	29	39·3	2	0	...
VII.		Leicester	3·91	...	1·34	15	15	80·7	29	41·0	17	0	5
,,		Boston	4·18	+ 1·93	1·45	15	13	82·0	29*a*	42·0	18	0	...
,,		Grimsby (Killingholme).....	2·27	— ·10	·83	25	13	75·0	29	45·5	6	0	...
,,		Hesley Hall [Tickhill].....	3·28	...	·97	15	12	80·0	29	38·0	7	0	...
VIII.		Manchester (Ardwick).....	3·78	+ ·62	1·54	26	16	78·0	30	47·0	6	0	...
IX.		Wetherby (Ribston Hall) ...	2·94	+ ·07	·95	30	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·30	+ ·48	1·30	25	17	75·0	13*a*	35·0	17	0	...
X.		North Shields	2·33	+ ·30	1·03	25	17	75·5	29	38·0	8	0	...
,,		Borrowdale (Seathwaite).....	8·09	+ ·28	1·99	26	14	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	3·31	+ ·25	1·21	27	18	...	...	...	...	...	...
,,		Haverfordwest	4·15	+ 1·12	1·27	27	15	77·0	5	41·0	7	0	...
,,		Plinlimmon (Cwmsymlog) ...	4·83	...	·70	15	19	...	...	...	...	...	...
,,		Llandudno.....	1·70	— ·30	·36	19*c*	11	70·4	29	44·8	6	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·85	— ·32	·88	25	15	71·0	9	38·8	18	0	...
,,		Hawick	3·64	+ 1·13	1·85	25	14	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	2·45	— ·56	·90	25	13	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	4·39	+ ·55	1·73	26	14	...	...	...	...	...	...
,,		Appin (Airds)	2·92	...	...	...	...	...	...	...	...	...	.
,,		Mull (Quinish).....	3·83	...	·98	29	18	...	...	...	..	...	...
XVI.		Loch Leven Sluices	2·60	— ·17	1·10	26	8	...	...	...	...	...	...
,,		Arbroath	2·08	— ·53	1·14	25	12	72·0	12	40·0	8,18	0	...
XVII.		Braemar	2·63	— ·46	·34	25	16	70·0	30	34·0	8	0	7
,,		Aberdeen	1·16	...	·47	25	12	...	...	...	...	...	...
XVIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	·89	— 1·36	...	..	...	71·0	30	35·2	21	0	7
XIX.		Dunrobin	1·66	...	·42	24	12	68·5	30	39·5	21	0	...
,,		Orkney (Sandwick)..... ..	...	...	...	...	...	...	...	..	...	...	...
XX.	IRELAND.	Cork (Blackrock)	2·38	— 1·17	·46	27	16	62·0	12	43·0	26	0	...
,,		Dromore Castle	3·13	...	·80	28	18	73·0	4	...	...	...	...
,,		Waterford (Brook Lodge) ...	2·40	...	·52	9	16	73·0	5	41·0	17	0	...
,,		Killaloe	2·56	...	·49	29	18	80·0	...	40·0	27	0	...
XXI.		Portarlington	1·83	— ·60	·26	17	20	72·0	3	42·5	15	0	...
,,		Dublin (FitzWilliam Square)	1·93	— ·27	·28	17	18	70·1	30	44·4	16	0	0
XXII.		Ballinasloe	2·98	— ·21	·82	29	18	68·0	8	41·0	16*b*	0	...
XXIII.		Waringstown	1·33	— 1·33	·28	19	13	85·0	24	36·0	2	0	1
,,		Londonderry (Creggan Res.).	2·21	...	·29	24	19	...	...	...	...	...	...
,,		Omagh (Edenfel).....	2·56	— ·49	·47	25	21	70·0	30	38·0	2	0	...

+ Shows that the fall was above the average ; — that it was below it.

a And 30. *b* And 17, 20, 21. *c* And 24.

METEOROLOGICAL NOTES ON JUNE.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—Weather at first fine, but during the last week very unsettled, heavy storms of R interrupting haymaking, but greatly benefiting all crops, especially the roots. Altogether the prospects are more favourable than for some years past, although the season is late. Hay cut on 4th. TS on 10th.

BANBURY.—TSS on 10th, 26th, and 29th; T and L on 8th, and T on 21st.

CULFORD.—Early part of the month very dry, with hot days and cold nights; vegetation suffered from the drying east winds. On the 13th, and to the close of the month, gentle and refreshing R fell. Tempest on 24th; T on the 13th, 16th, 26th, and 30th.

COSSEY.—The rainfall in the county varied very much; at Fakenham, I believe, over 3·30 inches fell between 13th and 16th inclusive.

BODMIN.—Magnificent weather up the 14th, after which R fell on nearly every day. Mean temp. 61°·3.

CIRENCESTER.—A favourable month for the crops (the land having been rather dry previously), but not very favourable for haymaking.

ORLETON—The first 14 days fine and dry, with much sunshine, except from the 7th to 10th, when there were clouds and showers every day and frequent very distant T. The remainder of the month was generally cloudy, with R on every day but two, and a low temp. till the 23rd. Mean temp. of the month rather more than 1° below the average of 20 years; T heard on 7 days; L seen on 3 days. The weather was very favourable for vegetation and for all farming operations.

LEICESTER.—The month has been a changeable one, sometimes very hot, and then somewhat cold, with much T and L, sometimes very heavy. The outlook for harvest upon the whole is good, though dry and settled weather would be acceptable; potatoes a very good crop, fruit of most kinds is abundant.

BOSTON.—A great deal of T and L at the end of the month, accompanied by heavy R; on 26th a very severe hailstorm passed over Boston, doing a great deal of damage to the gardens and fields, cutting the beans down to the ground, leaving the gardens bare of every flower, and the gooseberries and currants lying on the ground. The wheat came in ear about the 27th.

KILLINGHOLME.—On the whole a very fine month. T heard on several days, but no TS except on 29th, and that not severe. Beginning of month very dry; very fine rains afterwards; crops full of promise.

HESLEY HALL.—During the first three weeks weather cool, but with plenty of sunshine; during the last week somewhat sultry, with hot sun, R and TSS.

MANCHESTER (ARDWICK).—On the whole a fine month, though a want of R during the early part caused serious inconvenience, there being a scarcity of water in some parts of Lancashire, but the R which began about the middle, has wonderfully improved the crops; the closing part of the month was deficient in bright sunshine. Temp. moderate with a few warm days and some cold nights. TSS on the 8th and 25th.

ARNCLIFFE.—TS and heavy R on 25th.

WALES.

HAVERFORDWEST.—The fine warm weather of the last month and the early indications of great heat have been gradually dissipated; after the 17th the weather has daily become more and more precarious; few days attain to anything like summer heat; wind constantly S. Haymaking prospects are gloomy, although the early heat, followed by so much R, has caused everything to grow luxuriously. The potato crop appears likely to be light. Temp. on the whole moderate and rather below the average.

LLANDUDNO.—Rainfall and temp. below the average; the month began and ended fine and warm, but from the 7th to the 22nd inclusive, the temp. was considerably below the average. Nearly the whole of the rainfall occurred from the 14th to 27th. In consequence of the dryness at the end of May and the beginning of this month, the pastures failed and the hay crops are much under the average. There were 182 hours of bright sunshine.

SCOTLAND.

CARGEN.—Rather a dull month with want of sunshine, vegetation has, however, made good and satisfactory progress. Mean temp. 2°·8 below the average. T on 9th and 25th.

HAWICK.—A fine genial month, the blossom on all trees and shrubs being most abundant; very severe TS on 25th.

KILMORY.—Dry at the beginning of the month, but with very cold winds, which retarded vegetation. Severe TSS on 26th, accompanied by high wind which blew down a great many branches of trees, and knocked about many of our herbaceous plants; the R fell in torrents for over 6 hours, during which time 1·60 in. was registered, causing many of the small streams to overflow.

BRAEMAR.—A fine genial month; foliage luxuriant.

CULLODEN.—Very dry month, especially the first half; pasture and cereals on light lands suffering.

IRELAND.

DROMORE.—A favourable month for all crops, which were backward on account of the low temp. of May.

WATERFORD.—The early part of the month was warm and dry; the latter half very unsettled, S.W. wind prevailing during the last 10 days; T on 9th and 26th.

DUBLIN, FITZWILLIAM SQUARE.—The earlier portion of the month was fine and often bright; after the 13th the weather was cloudy, showery, and generally changeable and cool; the last three days were warm. Mean pressure identical with that of May, mean temp. 1° below the average, rainfall slightly under, and number of rainy days four in excess, of the average. TS occurred on the 19th, T was also heard on the 8th, H fell on the 15th, solar halo seen on 13th.

BALLINASLOE.—Weather very changeable, being warm at the beginning and end of the month. Strong and cold east winds prevailed from the 7th to 26th, doing much injury to vegetation; very heavy T showers occurred on the last few days of the month. T and L on the 10th and 29th.

WARINGSTOWN.—A splendid month, warm and genial, rainfall a little below requirements, but vegetation on the whole most luxuriant.

EDENFEL.—First week fine and dry, remainder of month dull and cloudy, with more or less R on almost every day; all crops (except force-grass hay) luxuriant.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCXI.] AUGUST, 1883. [PRICE FOURPENCE, *or 5s. per ann. post free.*

METEOROLOGICAL BIBLIOGRAPHY.

WE are glad to appropriate our first page this month to a notice of Dr. Hellmann's Repertorium,* a work of which any man might be proud, a work without parallel or precedent in our branch of science, and one which, while absolutely indispensable to every student of the meteorology of Germany, cannot be safely ignored by any one who desires (before rushing into print) to ascertain what has been suggested, what has been found useful, and what has been proved useless by those who have gone before him.

Dr. Hellmann was supposed to be preparing a bibliography; he has done that, and he has also done very much besides. In upwards of five hundred large octavo pages he gives a mass of information, of which the following is a brief list:—

PART I.—BIBLIOGRAPHY.

(1) A list of German authors, their writings and inventions, classed alphabetically under author's names.

(2) A subject catalogue referring for details to the previous section.

PART II.—CATALOGUE OF OBSERVATIONS.

(3) A list of all the places in Germany at which Meteorological observations are being, or have been, made, arranged alphabetically under the names of the stations.

(4) List of the stations grouped in States, and various other important lists of stations and systems.

PART III.—HISTORICAL.

(5) Epitome of the History of Meteorological observations in Germany.

(6) Chronological notes upon the progress of Meteorology in Germany.

(7) Statistical.

* Repertorium der Deutschen Meteorologie. Leistungen der Deutschen in Schriften, Erfindungen und Beobachtungen auf dem Gebiete der Meteorologie und des Erdmagnetismus von den ältesten Zeiten bis zum Schlusse des Jahres 1881. Von G. Hellmann. Mit einer Karte und einer lithographischen Tafel. Leipzig: Wilhelm Engelmann, 1883.

We cannot, within any ordinary limits, lay before our readers a full account of the contents of this Repertorium, but we will take it systematically according to the sections we have just quoted, and reprinting the first entry in each, both in the original and translation; we shall at any rate give our readers some idea of the labour which Dr. Hellmann has undertaken and completed.

Abendroth, William.—Dr. phil. Prof. d. Math. u. Phys. a Gymn. zum heiligen Kreuz in Dresden (*Or*),
geb. 1838, Juli . . ., Pirna.
Ueb. die opt. Erscheinungen in d. Atmosphäre. Jahresb. Ver. Erdk. Dresden, xv, 1878, p. 40.

ABENDROTH, WILLIAM, Doctor in Philosophy, Professor of Mathematics and Physics at the College of the Holy Cross at Dresden. (*Information specially communicated.*) Born 1838, July (? date), at Pirna.
"On optical phenomena in the Atmosphere." Fifteenth Annual Report of the Geographical Society at Dresden, 1878, p. 40.

Thus it will be seen that the bibliography is also a biography. Take for instance the next entry, that of the author of one of the best treatises upon Hail.

"ABICH, WILLIAM HERRMANN, Doctor of Philosophy (Berlin, 1831). After scientific travels, appointed in 1842 Professor of Mineralogy at the University of Dorpat, but in order to further his geological studies residing chiefly in Transcaucasia; later (1853) made a member of the Academy of Sciences, St. Petersburgh, and in 1866 elected an honorary member of that body. Since 1877 has resided principally at Vienna. Born December 11th, 1806, at Berlin."

On the next page we find a notice of a Yorkshire meteorologist, who lived about 250 years before William the Conqueror. We are not joking. The details are too full for us to quote them all, but the following is an abstract:—

"ALCUINUS (Alchuin), Director of the Cloister School at York, in England, until (in 782) Charles the Great made him a member of the learned body attached to his Court. Subsequently Alcuinus established numerous schools in France, and became Abbot of St. Martin at Tours (France). He was born at York in 736, and died May 19th, 804, at Hersfeld, in Hesse. According to some authorities it was Alcuinus, and according to others it was his patron, Charles the Great, who first adopted the plan of indicating wind direction to 16 points, by compounds of the four words, East, South, West and North."

We must pass to Section (2) Subject Catalogue, and give a few lines as a specimen of it:—

Abenddämmerung.— s. Dämmerung.

Abendroth (Abendröthe).—s. Dämmerung.

Abendwind (Nachtwind).—s. Winde lokalen Charakters.

. . . . . .

Aequatorialstrom.
Mühry 20. 29 (1866-7).

EVENING TWILIGHT. — See Twilight.

EVENING RED.—See Twilight.

EVENING WIND (Night wind). —See Wind, its local phenomena.

. . . . . .

EQUATORIAL CURRENTS. — Mühry, 20 and 29, 1866-7. (*i.e.* See, in the first section, the works by Mühry, which have the rotation numbers 20 and 29, and which were printed in the years 1866 and 1867).

Section (3) is the alphabetical list of stations, but, as will be seen it not only gives their names, but almost a history of each. The first is a very good example—it is Aachen, or, as it is more generally called in this country, Aix-la-Chapelle.

Aachen (Preussen 50° 47′ N, 6° 5′ E, 177m.)	AIX-LA-CHAPELLE, (Prussia, lat. 50° 47′ N., long. 6° 5′ E., (of Greenwich), altitude 177 metres (581 ft.) above sea level.
(*a*) 1838-47 Nov.; 6, 2, 10; Heis; Heis 1. Berlin (c) 1.	(*a*) Observations from January 1838, to November, 1847, taken at 6 a.m., 2 p.m., and 10 p.m. daily, by Prof. Heis, and published both by himself and also by the Royal Prussian Meteorological Institute.
(*b*) 1847 Dec.—52 Feb.; 6, 2, 10; Heis; Berlin (c).	(*b*) A second series in continuation of the first (but not published by Prof. Heis), and ending with February, 1852.
(*c*) 1868 Apr. ff. (m. Unterbr.); 6, 2, 10; Schaper, Sieberger; Berlin (c). Seit 1879 in extenso: Deutschland.	(*c*) A third series, beginning in April, 1868, and continuing to the present time (but with interruptions), made by Messrs. Schaper and Sieberger, and published similarly to *a* and *b*. Since 1879 the observations have been published *in extenso*.
***Lit.*: Heis 1. Schervier. Sieberger.**	The literature upon the climate of the city consists of papers by Prof. Heis, Dr. Schervier, and Prof. Sieberger.

Concerning Section (4), we have space to give only the titles of the various groups of data, *e.g.*, List of stations grouped in States; List of stations at which the observations are printed *in extenso*; Stations at which observations are made at least six times a day; Forestry stations; Signal stations belonging to the German Naval Observatory; Stations making synchronous observations for the U. S. Signal Office; Stations at altitudes exceeding 600 metres (1969 feet). (There have been altogether 66 such stations, and 44 are still at work) Stations at which observations have been made for 50 years or more. Of these there are 51, some with tremendously long records, *e.g.*, Breslau, 126; Danzig, 205; Berlin, 210 years. (While we regard these records with considerable reverence, we cannot help thinking that during such long periods, the changes in instruments, observers, and exposure must have been such that they can hardly be regarded as single and strictly comparable.) List of observers' names (1155) classed alphabetically.

Section (5) is appropriately divided into three periods:—

(1) Weather observations made without instruments.
(2) Instrumental records not systematically organized by the State.
(3) Modern organizations.

We cannot go through these in detail, but together they form a

complete history (comprised in about 50 pages) of the meteorological observations and societies of Germany.

Section (6) is much shorter. It gives in chronological order the leading features of meteorological progress in Germany. We take the first and a few other entries.

Middle of 8th century. The monk Vergilius, who was preaching Christianity in Bavaria, wrote a "*Decalogium de Metheorologicis impressionibus.*"

1480. An anonymous author wrote "*Ein hübscher schoener Kalender mit etlicher zugehörung . . . vnd von den vier winden vnd irer Natur.*"

1497. First published description of a storm (in Pomerania).

1576. Weather observations begun at Dresden.

1604. Kepler began regular weather observations at Prague.

1691. Camerarius began at Tübingen regular records of barometer and thermometer—probably the first in Germany.

1712. Algöwer made at Ulm the first records of rainfall in Germany.

1761. Aepinus made the first investigation of the distribution of temperature over the earth.

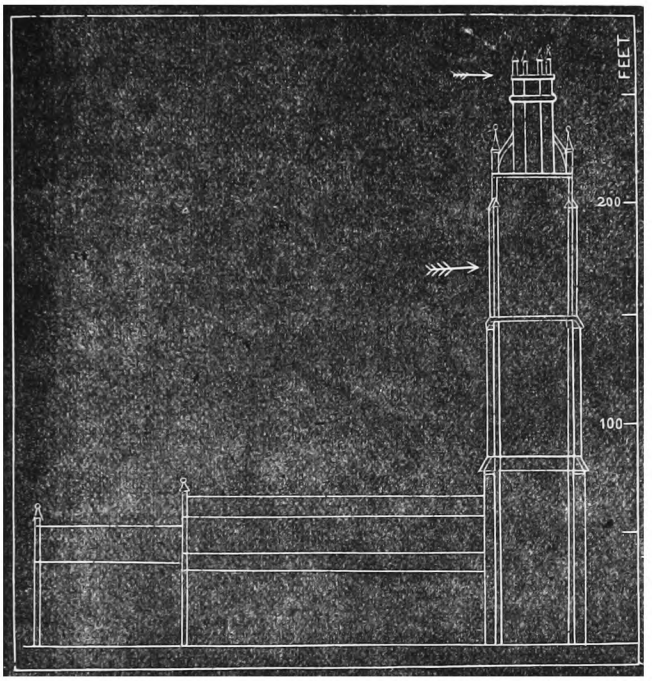
The seventh and last section is entitled Statistical, and gives the number of publications and of stations in each year, and various deductions from those numbers; of course they show very markedly the great activity which has characterized meteorological work in recent years. Possibly the following paragraph is as well worthy of thoughtful consideration as any wherewith we could close this notice of Dr. Hellmann's extremely useful book :—

"I estimate the number of books and papers upon Meteorology and Terrestrial Magnetism which appear yearly at present at 800. Therefore, anyone who wishes to read them all must read two every day in the year, which no one would do for pleasure, and few from a sense of duty. I must, therefore, with relation to these facts, bring prominently forward the suggestion (which I have long discussed personally with leading meteorologists) that a *Yearly Report on the Advance of Meteorology*, prepared by the joint labour of experts, is a pressing need, as is also the combination in one General Catalogue of all the separate lists yet published."

TEMPERATURE OBSERVATIONS AT BOSTON, LINCOLN

IN the *Meteorological Magazine*, vol. xvii., p. 20 (March, 1882), we gave a description of the arrangements then recently made for determining the temperature at 4, 170 and 260 ft. above the ground at Boston in Lincolnshire. To save trouble we reprint the sketch of the church, with the arrows pointing to the sites of the upper thermometers, and may remind our readers that there is a complete set

of thermometers in a Stevenson screen in the churchyard, another at 170 ft., and at 260 ft. there is a thermometer, the indications of which are recorded electrically at the base of the tower.



At the last meeting of the Royal Society before its adjournment, a paper was read by Mr. G. J. Symons, entitled, "Note on the Establishment and First Results of Simultaneous Thermometric and Hygrometric Observations at Heights of 4 and 170 feet, and of Siemens' Electrical Thermometer at 260 feet above the ground."

We think that it may be of interest to reprint some portions of this paper, referring those who desire full details to the Proceedings of the Royal Society.

It is just a century since James Six (the inventor of the well-known Six's registering thermometer), commenced some occasional comparisons of the temperature of the air at the top and bottom of the tower of Canterbury Cathedral. We do not know precisely the position in which the instruments were placed, and, as thermometer screens had not then been invented, his observations can only be accepted as approximately correct; but as the work in which they are recorded is rather scarce, it may be well to give an analysis of the results. The observations were not consecutive, but made at various dates during 1784-92; the lower thermometer was five feet, and the upper one 220 feet above the ground. The daily maxima were about 1° warmer at the top during all frosty periods; alike at the top and the bottom when the temperature was between 40° and 50°, and lower at the top by from 3° to 5° when the temperature was above 50°. The minima gave analogous but more marked differences. Some very severe frosts occurred while these experiments were in progress, and

with bottom temperatures of —2°·5, +6°, and +6°·5 respectively, the top temperatures were 15°, 17°, and 21°, showing an excess at the top of 17°·5, 11°, and 14°·5. In ordinary weather the excess of the top minima was not so great, but the average excess was 6°, and there was not a single night when it was colder at the top than at the bottom.

The author is not aware of any further experiments having been made upon this subject until 1861, when the Rev. R. Main, F.R.S., had a record commenced of a Six's registering thermometer, and dry and wet bulb thermometers placed near the anemometer on the Radcliffe Observatory, Oxford. These instruments were 105 feet above the ground, and were read about 9 a.m. in conjunction with other thermometers at 5 feet above the ground. The readings of these instruments have since that time been published *in extenso*, but the author has seen no discussion of them, and is not aware whether the thermometers have been verified or not, nor how they are mounted.

In 1868 Mr. James Glaisher, F.R.S., instituted a series of readings of the dry and wet bulb thermometers at the Royal Observatory, Greenwich, at the respective heights of 4 feet, 22 feet, and 50 feet above the ground. The observations, which are published *in extenso* in the "Proceedings of the Meteorological Society," vol. v., p. 29, extend only from June 25 to August—a period of six weeks during the hottest part of the year. The results show that during the day hours the temperature at 4 feet was at times 7° and 8° higher, and at night 3°, 4°, and 5° lower than at 50 feet above the ground.

In 1872-74 Professor H. Wild carried out experiments with thermometers and hygrometers placed at the heights of 6 feet, 52 feet, and 86 feet above the ground on a scaffolding at the Pulkowa Observatory. ("Repertorium für Meteorologie," vol. v.)

During 1873-75 readings of maximum and minimum, and dry and wet bulb thermometers were made on behalf of the Meteorological Office at the Kew Observatory, 10 feet, and on the ornamental Pagoda in the Royal Gardens, Kew, at the respective heights of 22 feet, 69 feet, and 129 feet above the ground. Mr. R. H. Scott, F.R.S., in concluding his report on these observations ("Quarterly Weather Report," 1876, Appendix 3), says: "That so far as the evidence adduced in this paper goes, it indicates that, on the average of a considerable series of observations, the influence of height on mean thermometrical and hygrometrical results is not very great, but that on individual occasions very material differences are observed."

Lastly, Mr. G. Dines has recently communicated to the Meteorological Society ("Quarterly Journal," vol. viii., p. 189), the results of observations which he has made with thermometers placed 4 feet and 50 feet above the ground at his residence, Hersham, Walton-on-Thames. These observations, which extended from September, 1876, to September, 1878, inclusive, show that on the average the mean daily range of temperature at 50 feet was 2°·1 less than at 4 feet, the mean of the maxima at 50 feet being 1°·2 lower, and the mean of the minima 0°·9 higher than at 4 feet.

It will be seen from the above abstract that up to the end of 1881, there was no precise information as to the form of the curve of daily temperature at considerable heights above the ground. It was known that the amplitude of the daily range was materially reduced, but the amount of the reduction was unknown, and, owing to the absence of hourly readings at night, no data existed for determining the shape of the curve during the night and early morning hours.

The paper then gives full details as to the instruments and their positions, also a synopsis worked out by Mr. Marriott of the results hitherto obtained. Leaving all the tables and details the following are the principal results :—

4 FEET AND 170 FEET.

From April to December, 1882, the mean maximum temperature at 4 feet exceeded that at 170 feet by 1°·9, while the mean minimum temperature at 4 feet fell below that at 170 feet in almost every month, the mean difference being 0°·4. The range of temperature was, therefore, 2°·3 less on the belfry, than at 4 feet above the ground.

The temperatures at 9 a.m. show that on the average the air at 4 feet was 1°·3 warmer than at 170 feet.

These results are generally consistent with the assumption that the heat felt near the earth's surface is due to the action of the heat rays on that surface, and not on the air through which they pass—but the excess of the 4 feet temperature at 9 a.m. is somewhat greater than we expected. However, we see from the next series of observations that at 9 a.m. the difference between 4 ft. and 260 ft. is 1°·9, therefore we have in that corroboration of the above values, for the figure run thus :—4 ft., 51°·0; 170 ft. 49°·7; 260 ft. 49°·1. Now if we plot these values, we shall find that while the observed temperature at 170 ft. was 49°·7, the temperature calculated from the 260 ft. and 4 ft. observations, assuming a uniform rate of decrease, gives 49°·8, in fact the results of the two methods agree within a tenth of a degree.

4 FEET AND 260 FEET.

Night observations are generally difficult to obtain, hence it was only possible to arrange for the electrical thermometer being read bi-hourly between 9 a.m. and 9 p.m. This, however, was done daily from April 1st to December 31st. The result was to give for every month, and for every hour (day only be it remembered) a higher mean temperature near the ground than at 260 feet. The greatest mean excess at 4 feet was 3°·6 at 9 a.m. and at 11 a.m. in July; the least was 0°·2 at 9 p.m. in November. The following are the mean values for the 10 months.

9 a.m.	hotter at	4 ft.	than at 260 ft.	by 1°·9
11 a.m.	,,	,,	,,	2°·3
1 p.m.	,,	,,	,,	2°·2
3 p.m.	,,	,,	,,	2°·2
5 p.m.	,,	,,	,,	1°·7
7 p.m.	,,	,,	,,	1°·3
9 p.m.	,,	,,	,,	0°·8

On examining the individual readings for each day, two interesting features are clearly brought out, viz., (1) that in fine bright weather the temperature at 4 feet during the day is much higher than on the top of the tower,—in summer the difference sometimes reaches 5° at 1 p.m.; and (2) that in foggy weather the temperature at the top of the tower is always higher than at 4 feet, the upper part of the tower being generally free from fog. In cloudy and wet

weather the temperature is uniformly higher in the churchyard than at the top of the tower.

On eight occasions during last winter it was found to be possible to read the thermometers every hour day and night, and the results prove that especially on clear nights, when terrestrial radiation is active, it is not infrequently warmer at 260 feet than at 4 feet. The difference on the night of Nov. 11th, which was clear and cold, was very great, the temperature at the top of the tower being warmer than in the churchyard by 5°·6 at 11 p.m., 6°·8 at midnight, and 6°·4 at 1 a.m.

More observations of this class are urgently needed, but the following conclusions appear to be supported by the records hitherto obtained.

The prevalence of fine clear nights is readily seen by the increased temperature at the upper station; the presence of fog is also indicated in a similar manner; while cloudy skies, rain, and wind prevent radiation, and so on days and nights of their occurrence the temperature is always highest near the ground.

From the foregoing it seems that the difference between the temperature at 4 feet and 260 feet is chiefly regulated by the amount of cloud, and by the relation of the temperature of the surface of the ground to that of the general body of air passing over it. If so, it will follow that the mean difference between the temperature at the two heights can only be determined by very numerons observations, or by careful considerations of the conditions of weather and of soil temperature under which each individual set is made.

ON LIGHTNING FIGURES.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to see that you and Mr. Bruce have adopted my views as to the formation of ramified figures, which have frequently been noticed on human beings and animals that have been struck by lightning. A ramified figure, produced under such circumstances, would naturally lead a non-scientific observer to associate such a figure with that of a neighbouring tree, and in reporting the occurrence, he would be likely to call it "an exact representation of the tree;" while any little blotch he would represent as "a bird and nest on one of its branches." I am not aware that any scientific man has ever actually witnessed a case of this kind, but when the patient is taken to a medical man, he is apt to fall back upon his knowledge of anatomy for an explanation, and speak of "the eruption of blood in the vessels of the skin, producing an effect like that of an injection." In a case reported by a medical man in the *Lancet*, for July, 1864, Dr. Mackintosh, referring to a boy who took refuge under a straw stack, says, "The figures on either hip were so exceedingly alike, and so striking, that an observer could not but be impressed with the idea that they were formed in obedience to some prevailing law." In this case, and many others, no tree was near. One case recorded in *Nature*, for March 25th, 1875, by Mr. Pidgeon, at Torbay, close

to the sea, is very well reported, because he relates the facts as they occurred, without any attempt to explain them. Mr. Pidgeon, his wife, and his son, were standing under a flag-staff, looking out upon the bay, when the vane was struck by lightning, and shivered. Mrs. Pidgeon was struck, and fell to the ground, and her lower limbs and left hand became rigid. On examining the body from the feet to the knees she was splashed with rose-coloured tree-like marks, branching upwards; while a large tree-like mark, with six principal branches diverging from a common centre, 13 in. in its largest diameter, and bright rose-red, covered the body." On recovering, Mrs. Pidgeon declared that she saw nothing of the flash, but described her feeling as that of "dying away gently into darkness, and being roused by a tremendous blow on the body, where the chief mark was afterwards found."

When my paper was read before the Physical Section of the British Association at Manchester, in 1861, the astronomer royal was in the chair, and on showing him some of my electrical figures after the sitting, he patted me on the back, and said, "You have settled that matter!" I also produced the figures in the presence of my friend, the late Professor Miller, of King's College; and on breathing on one of the plates, he exclaimed, "There's the tree, capitally made bird's nest, and all!" I may remark that persons have complained to me of their inability to produce these figures. The following directions will make their production easy. Squares of common crown window glass, about 4 in. to the side should be steeped in a strong solution of soap and water; and before an experiment, a plate should be taken out, and wiped dry with a duster. This will leave an exceedingly thin film of soap on the surface of the glass. A Leyden jar of about a pint capacity should be charged, and the plate being held by one corner, be brought up to the knob of the jar, while one knob of the discharging rod should be placed on the outer coating of the jar, and the other knob be brought opposite the knob of the jar, in contact with the glass. A discharge will now take place over the surface of the plate; and passing over its edge reach the upper knob of the discharging rod. If we now breathe on the surface of the plate, a tree-like figure, consisting of trunk, branches, and spray, will be beautifully made out, because wherever the electricity touched the plate, the soapy film is burnt off, and the plate rendered chemically clean, so that the breath condenses in watery lines on those parts, and in minute globules of dew on those parts where the film still remains. On the other side of the plate, there is also a figure, but it is marred by contact with the knob of the discharging rod.

In the last edition of my book on "The Thunder Storm," published in June, 1877, by the S.P.C.K., a long account is given of these figures (p. 331 to 358), and the subject is so far completed that the production of other figures is explained, which were inexplicable at the time when my first paper was written. For example, a sailor,

sitting under the mast of a brigantine, was struck dead by lightning, and on his back was found the impression of a horse-shoe, similar in size to one fixed at the mast-head. And in another example, a sailor had on his body the impression of a number "4·4," with a dot between the two figures, being the same in all respects as the brass number "4·4" which was at the extremity of one of the masts. In another example, a young man struck by lightning had on a girdle containing gold coins; these were imprinted on his skin, in the same manner in which they had been placed in the girdle.

In such cases as these an explanation is to be found in some phenomena brought before the Royal Society by Mr. C. F. Varley (*Proceedings*, January 12th, 1871). He was working a Holtz electrical machine, the poles of which were furnished with brass balls, about an inch in diameter. Noticing some specks on the ball of the positive pole, he tried to wipe them off with a silk handerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibited a glow, and if in this state three or four bits of wax or even a drop or two of water were placed on the negative pole, corresponding non-luminous spots appeared on the positive pole. Hence it is clear that by means of the lines of force existing between the two poles, we may telegraph through the air from the negative to the positive pole; and in explanation of the above cases, in which the lightning-burn on the skin is of the same shape as the object from which the discharge proceeded, all that is necessary is that the object struck be positive to the horse shoe, brass number, &c., the discharge being negative; in this way such cases as those alluded to are taken out of the region of the marvellous, and become instructive, illustrative facts in science.

Illustrations of similar phenomena may also be deduced from some of the appearances in Mr. Crookes's Vacuum Tubes.

The figures obtained by my method have nothing in common with "such as occur on deflagrating a sheet of gold leaf," as you suppose. My figures illustrate in a variety of ways the complicated action of a flash of lightning; but for these details I must refer to my book, and to the wood engravings which illustrate it.

I remain, Sir, sincerely yours,

CHARLES TOMLINSON.

Highgate, N., 18th July, 1883.

PROF. LEMSTRÖM'S OBSERVATIONS ON AURORÆ.

To the Editor of the Meteorological Magazine.

SIR,—I have the honour to inform you that the Government has granted a sum of 37,000 marks (£1,480) for the continuing of scientific inquiries in Finnish Lapland.

These investigations will include the electrical current which

produces the aurora and the terrestrial currents, the magnetic perturbations, &c.

The expedition will depart for Lapland, the 25th of August, 1883.

Your obedient servant,

SELIM LEMSTRÖM.

Laboratoire de Physique, Université de Helsingfors, Finlande, 6th Aug., 1883.

[WE are sure that the above announcement will be read with extreme pleasure; it is creditable to the Finnish Government to have furnished the necessary funds; it is courageous of Prof. Lemström to face the discomforts, not to say dangers, of night observations with temperatures far below zero. With such men as Lemström and Tromholdt attacking the problem of the aurora from different points, there can be little doubt that its precise nature and cause will soon be determined. It would probably be well for all observers to be especially watchful for auroral phenomena during the coming winter.—ED.]

VAPOUR TENSION.

To the Editor of the Meteorological Magazine.

SIR,—At the last exhibition of meteorological instruments at the Meteorological Society, the drawings of two Atmospheric Vapour Meters were exhibited, one by my father, the other by myself. The latter has been in use since last January, and I now send you a specimen of the results obtained.

Dry Bulb.	Wet Bulb.	Tension.	
		By calculation.	By meter.
60·5	57·8	·439	·302
64·5	58·8	·418	·263
64·0	57·4	·387	·249
64·0	56·6	·367	·223
64·8	56·5	·355	·205

The method employed is to take a given volume of air, and after extracting the vapour by means of sulphuric acid, and restoring the air to its original volume and temperature, to note the loss of pressure. It will be seen that the tension obtained by experiment is less than that given by the tables, and I have no doubt that further investigation will show that the tension of vapour when mixed with air, and not in the presence of water, is less than is generally supposed.

Yours truly,

W. H. DINES.

Burgess Hill, Sussex, July 28th.

[We are not aware whether Mr. W. H. Dines has yet sufficiently tested his apparatus to enable him to regard the construction as finally adopted, but if so, we think it is very desirable that it should be engraved and fully described—our pages are at his service for that purpose.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1883.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	57·3	28	29·3	17	49·0	36·5	38·8	85	100·8	24·4	3·62	14	6·3
Cape of Good Hope	..	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·8	7	70·4	26	82·5	74·6	70·0	76	...	...	4·38	19	6·2
Calcutta	89·5	20	46·2	8	79·4	57·1	55·8	67	145·0	32·3	2·09	2	2·4
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	85·7	24	61·0	2	82·5	67·8	64·2	67	143·6	51·3	·00	0	1·2
Ceylon, Colombo	89·7	18	67·8	10	86·7	73·4	68·4	67	151·0	60·0	1·69	3	4·7
Melbourne	100·0	16	46·4	20	78·2	58·2	54·1	66	162·0	37·9	1·57	7	5·6
Adelaide	109·3	15	49·0	28	82·9	60·1	51·0	50	164·3	44·4	·38	6	4·6
Wellington	85·0	21	51·0	28	72·3	59·2	...	...	144·0	49·0	5·22	12	...
Auckland	80·4	15	58·2	27	74·9	64·6	62·6	78	131·5	43·0	4·80	16	7·9
Falkland Isles	62·2	17	33·0	28	54·7	42·0	45·7	86	124·8	28·8	2·99	14	7·2
Jamaica, Kingston	90·4	4	64·9	23	86·3	68·6	66·3	74	...	57·0	·31	6	2·8
Barbados	79·0	var.	67·0	20†	78·0	70·0	69·8	78	143·0	65·0	2·15	15	6·0
Toronto	44·1	16*	−10·5	10	27·4	11·3	17·2	80	118·0	−14·0	2·85	18	6·2
New Brunswick, S. John	40·0	17	−10·0	11	26·6	8·8	18·0	91	...	...	2·85	9	5·0
Cape Breton, Sydney	...	...	...	...	...	...	...	...	...	...	..	...	...
Manitoba, Winnipeg	33·3	27	−40·9	2	5·9	−17·9	−1·5	76	100·5	...	·68	5	3·7
British Columbia, Yale	43·7	28	−36·3	4	23·2	−1·7	...	...	...	...	1·64	8	4·4

* And 17 † And 27.

REMARKS, FEBRUARY, 1883.

Mauritius.—Rainfall 1·29 in. below the average; mean temp. 0°·5 below it; mean pressure (29·908 in.) ·032 in. below the average; mean hourly velocity of wind 11·3 miles, extremes 28 miles on 7th, and 0 miles on 20th; T and L on 12th, 13th, and 19th. C. MELDRUM, F.R.S.

Ceylon.—TSS occurred on the 5th, 6th, 7th, and 8th; L was seen on 4th and 9th.

Melbourne.—Mean temp. of air and of dewpoint, and mean amount of cloud all slightly above the average; humidity the same as the average; mean pressure and total R both below it; prevailing direction of wind S. and S.W., strong breezes occurring on seven days, violent squalls on the 28th; TSS on the evenings of the 8th and 9th; thick fog on the morning of the 12th. R. L. J. ELLERY, F.R.S.

Adelaide.—The month was exceptionally cool, the mean temp, being 2°·7 below the average, and the max. reaching 90° on only six days; rainfall only about half the average; mean pressure 29·896 in., being ·076 in. below the average of twenty-six years. C. TODD.

Wellington.—Generally stormy and unsettled, with some heavy R up to the 6th; from 7th to 16th generally fine with N.W. wind; stormy on 8th, 9th, and 13th; very heavy R on 17th and 18th; showery from 21st to the end of the month. Earthquakes occurred on 5th and 14th—both slight. Mean pressure slightly, and mean temp. 3° above the average; rainfall also considerably in excess. R. B. GORE.

Auckland.—Warm, but more than usually dull and showery; excessive R twice during the month, on 25th 2·64 in. fell; mean pressure 30·094 in.; greatest velocity of wind 626 miles from N.E., and N. on the 20th. E. B. DICKSON.

BARBADOS.—Mean temp. 0°·4 above the average of 25 years; prevailing direction of wind N.E.; rainfall 39 per cent. below the average of 25 years; evaporation 4 per cent. above it; two days were overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Rain.
		in.			in.
II.	Dorking, Abinger	...	XI.	Llanfrechfa Grange	4·93
,,	Margate, Birchington...	2·32	,,	Llandovery	5·67
,,	Littlehampton	3·82	,,	Solva	2·13
,,	St. Leonards	1·98	,,	Castle Malgwyn	3·15
,,	Hailsham	2·11	,,	Rhayader, Nantgwillt..	6·14
,,	I. of W., St. Lawrence.	2·21	,,	Carno, Tybrith	3·34
,,	Alton, Ashdell.....	2·28	,,	Corwen, Rhug	1·93
III.	Winslow, Addington ...	3·27	,,	Port Madoc	3·16
,,	Oxford, Magdalen Col...	3·53	,,	I. of Man, Douglas	1·75
,,	Northampton	3·43	XII.	Carsphairn	4·70
,,	Cambridge, Beech Ho...	2·77	,,	Melrose, Abbey Gate...	3·68
IV.	Southend	2·96	XIII.	N. Esk Res. [Penicuick]	4·10
,,	Harlow, Sheering	2·14	XIV.	Ayr, Cassillis House ...	2·33
,,	Diss	3·15	,,	Glasgow, Queen's Park.	3·48
,,	Swaffham	4·92	XV.	Islay, Gruinart School..	1·57
,,	Hindringham	2·92	XVI.	St.Andrews,NewtonBk	5·40
V.	Salisbury, Alderbury...	3·90	,,	Aberfeldy H.R.S.	6·79
,,	Warminster	4·08	,,	Dalnaspidal H.R.S. ...	5·03
,,	Calne, Compton Bassett	2·67	XVII.	Keith H.R.S.	4·96
,,	Beaminster Vicarage ...	3·06	XVIII.	Forres H.R.S.	4·38
,,	Ashburton, Holne Vic..	3·99	,,	Strome Ferry H.R.S....	2·62
,,	Torrington, Langtree W.	...	,,	Lochbroom	4·29
,,	Lynmouth, Glenthorne.	2·87	,,	Tain, Springfield.....	4·32
,,	Probus, Lamellyn	3·80	,,	Loch Shiel, Glenaladale	3·90
,,	Taunton, Fullands	2·57	XIX.	Lairg H.R.S.	4 54
VI.	Bristol, Clifton	3·67	,,	Forsinard H.R.S.	3·92
,,	Ross	3·27	,,	Watten H.R.S.	2·03
,,	Wem, Sansaw Hall.....	1·97	XX.	Fermoy, Glenville	4·97
,,	Cheadle, The Heath Ho.	2·63	,,	Tralee, Castlemorris ...	4·85
,,	Worcester, Diglis Lock	2·91	,,	Tipperary, Henry Street	3·31
,,	Coventry, Coundon	3·87	,,	Newcastle West	3·22
VII.	Melton, Coston	3·18	,,	Kilrush	...
,,	Ketton Hall [Stamford]	3·20	,,	Corofin	4·35
,,	Horncastle, Bucknall ...	2·18	XXI.	Carlow, Browne's Hill..	4·50
,,	Mansfield, St. John's St.	2·34	,,	Navan, Balrath	2·52
VIII.	Macclesfield, The Park.	3·13	,,	Athlone, Twyford	4·38
,,	Walton-on-the-Hill.....	3·85	XXII.	Mullingar, Belvedere ...	3·31
,,	Lancaster, South Road.	2·19	,,	Clifden, Kylemore	6·51
,,	Broughton-in-Furness ..	2·42	,,	Crossmolina, Enniscoe..	5·28
IX.	Wakefield, Stanley Vic.	3·12	,,	Carrick-on-Shannon ...	3·52
,,	Ripon, Mickley	3·76	XXIII.	Dowra	...
,,	Scarborough.....	2·98	,,	Rockcorry.....	3·62
,,	EastLayton[Darlington]	...	,,	Warrenpoint	3·83
,,	Middleton, Mickleton ..	3·47	,,	Newtownards	1·66
X.	Haltwhistle, Unthank..	3·53	,,	Belfast, New Barnsley .	2·57
,,	Shap, Copy Hill	3·65	,,	Bushmills	2·23
			,,	Buncrana	3·01

JULY, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·92	+ ·45	1·43	14	14	84·7	2	42·1	16	0	0
II.		Maidstone (Hunton Court)...	2·95	+ ·91	·46	12	17	...	...	...	...	..	...
,,		Strathfield Turgiss	2·81	+ ·51	·98	31	19	81·5	2	41·9	16	0	0
III.		Hitchin	3·56	+ ·86	·68	14	17	75·0	2,3	42·0	15	0	...
,,		Banbury	4·16	+ 1·18	1·18	2	20	79·0	2	41·5	15	0	...
IV.		Bury St. Edmunds (Culford)	4·15	+ 1·18	·93	14	19	86·0	2	39·0	19	0	..
,,		Norwich (Cossey)	2·66	— ·09	·60	3	19	83·5	3	39·0	20	0	...
V.		Bridport	2·79	...	·37	6*d*	18	...	..	...	...	...	...
,,		Barnstaple.....	4·73	+ 1·18	·87	22	21	76·0	3	47·0	27	0	..
,,		Bodmin	5·04	+ 1·60	·69	13	21	69·0	30	47·0	13	0	0
VI.		Cirencester	3·17	+ ·16	·71	20	18	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·66	— ·37	·55	20	21	73·5	2	42·0	15	0	...
,,		Tenbury (Orleton)	3·07	+ ·16	·91	20	21	77·0	2	38·0	15	0	0
VII.		Leicester	4·74	...	1·06	2	23	...	...	...	...	...	...
,,		Boston	2·49	— ·04	·85	20	15	80·0	2	43·0	20	0	...
,,		Grimsby (Killingholme).....	3·56	+ ·78	·77	2	22	7·45	2	47·0	20	0	...
,,		Hesley Hall [Tickhill].....	2·79	...	·81	20	17	76·0	2	39·0	20	0	...
VIII.		Manchester (Ardwick).....	2·77	— 1·04	·66	23	19	78·0	2	45·0	20	0	...
IX.		Wetherby (Ribston Hall) ..	4·39	+ 1·78	2·03	22	14	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·61	+ ·66	1·14	21	24	75·0	1,2	37·0	14	0	...
X.		North Shields	4·05	+ 1·50	1·53	21	18	77·2	1	41·0	23	0	...
,,		Borrowdale (Seathwaite).....	6·18	— 2·59	·86	16	25	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	3·56	— ·25	·88	20	19	...	...	...	...	...	...
,,		Haverfordwest	3·53	— ·40	·54	4	20	69·0	7*a*	43·0	20*b*	0	...
,,		Plinlimmon (Cwmsymlog) ...	5·22	...	1·04	30	22	...	...	...	...	...	...
,,		Llandudno.....	1·15	— 1·56	·30	4	13	67·8	2	47·8	20	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·49	— ·64	·59	7	16	72·2	28	40·2	20	0	...
,,		Hawick	4·04	+ ·92	·92	2	17	...	...	...	...	...	...
XIV.		Douglas Castle (Newmains)	2·77	— ·52	·50	21	14	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	2·57	— 1·97	·64	4	13	...	...	...	...	...	...
,,		Appin (Airds)	3·58	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	2·15	...	·33	4	17	...	...	...	...	...	.
XVI.		Loch Leven Sluices	6·60	+ 3·55	2·60	21	13	...	...	...	...	...	...
,,		Arbroath	4·23	+ 1·59	·84	2	19	72·0	10	46·0	16*c*	0	...
XVII.		Braemar	3·68	+ ·82	·58	3	22	68·0	1	34·2	28	0	...
,,		Aberdeen	3·64	...	·87	21	19	72·0	8	42·0	16	0	...
XVIII.		Skye (Sligachan)	3·50	...	·43	12	24	...	...	...	...	...	...
,,		Culloden	4·24	+ 1·46	·78	19	...	74·0	1	37·2	15	0	1
XIX.		Dunrobin	4·62	...	1·25	3	18	69·5	8	39·0	15	0	...
,,		Orkney (Sandwick)..... ..	1·85	— ·81	·55	22	12	69·0	1	45·0	15	0	0
XX.	IRELAND.	Cork (Blackrock)	4·26	+ 1·42	1·30	8	21	80·0	28	45·0	14	0	0
,,		Dromore Castle	4·39	...	·65	5	23	66·0	1	41·0	27	0	...
,,		Waterford (Brook Lodge) ...	4·51	...	·73	3	20	72·0	28	42·0	28	0	...
,,		Killaloe	7·26	...	1·30	8	24	78·0	28	43·0	28	0	...
XXI.		Portarlington	3·08	+ ·40	·49	4	24	71·0	1	46·5	27	0	...
,,		Dublin (FitzWilliam Square)	2·22	— ·20	·57	23	22	69·2	28	45·4	15	0	0
XXII.		Ballinasloe	3·32	+ ·44	·60	6	22	68·0	28	43·0	15	0	...
XXIII.		Waringstown	2·99	— ·59	·46	8	18	76·0	4,9	40·0	19	0	0
,,		Londonderry (Creggan Res.).	3·26	...	·57	11	24	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·59	+ ·34	·52	6, 11	20	69·0	8	44·0	13	0	...

+ Shows that the fall was above the average ; — that it was below it.

a And 8, 9, 30. *b* And 21. *c* And 17, 19 *d* And 29.

METEOROLOGICAL NOTES ON JULY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—Very unsettled during the greater part of the month, heavy storms being prevalent, but no serious damage was done; hay harvest much impeded, but many crops derived great benefit from the R.

BANBURY.—Very unfavourable for getting in the hay, and grain crops suffered from want of sun; mean temp. 3° below the average; TS on 2nd and 3rd, the most severe and longest for many years; T and L on 15th and 21st, T on 16th, high wind on 11th.

COSSEY.—A cold, wet month after the 13th, the max. temp. never reaching 70° after that date.

BODMIN.—A cold, rainy month; crops very backward. Mean temp. 59°·3, 2°·3 below the average.

CIRENCESTER.—A cool month; rainfall moderate in quantity, but in consequence of its general distribution over the month, the weather was not good for hay making.

WOOLSTASTON.—A cold month after the first week; mean temp. 56°·9.

ORLETON—Mean temp. of the month nearly 3° below the average of 22 years. The first thirteen days were warm and pleasant, followed by a cold period of eleven days, with a mean temp. about 7° below the average; the last seven days were warmer, but still below the average. The sky was generally obscured by cloud, with intervals of bright sunshine, and the air was damp, with a few spots of R almost every day, but the total rainfall was not greatly in excess of the average. Distant T was heard on five days, and L was seen on the night of the 2nd. Grass crops generally good, but much of the hay was injured.

LEICESTER.—The month was unsettled, R having fallen on 23 days; severe T and L early on the morning of the 3rd, and T and L with very heavy R on the evening of 13th, ·88 in. falling in 35 minutes. Bright sunshine much needed.

KILLINGHOLME.—A hailstorm of unprecedented severity occurred on the 3rd, accompanied by T, making fearful havoc amongst the corn; T and L on 4th and 14th, T on 11th.

MANCHESTER (ARDWICK).—The month opened with some genial showers, which were much needed by the country, and the temp., though not high, was moderately warm and genial, but as the month advanced, the weather became broken, and the temp. fell considerably, which retarded the crops very much, and interfered with haymaking, which was already late, owing to the dry spring.

WALES.

HAVERFORDWEST.—Another bad July, almost as bad as July, 1882, for the hay crop, much of which has unavoidably been damaged; there was very little sunshine, and the temp. was much below the average, never reaching 70°; cloudy, damp, and close weather prevailed throughout the month.

LLANDUDNO.—Temp. low, especially from 13th to 24th inclusive; the mean for the month was 3°·5 below the average, and the range, both diurnal and total, was very small. Only 136 hours of bright sunshine were recorded.

SCOTLAND.

CARGEN.—Many TSS occurred during the month, but none near this station; mean temp. 56°·8, 2°·9 below the average.

HAWICK.—A very fine growing month; TSS occurred on 2nd, 3rd, 11th, 13th and 14th.

KILMORY.—The weather at the beginning of the month was showery, close and warm, but after the 13th it became very dry, with rather cold winds; the

last 8 days were remarkably hot, and vegetation began to suffer from want of R.

QUINISH.—Cold and dry from the 17th to the 31st. Much of the hay crop was secured in splendid condition, and all other crops promise unusually well.

ABERDEEN.—Rainfall excessive, about an inch above the average; T and L on 12th, 17th and 23rd.

CULLODEN.—Temp. below the average, the 1st being the warmest day of the month. Frost on grass on night of 14th; distant T frequent; cereals all promising.

SANDWICK.—The rainfall was below the average, and the month was cold, owing to the prevalence of N.W. and S.E. winds; it was also very cloudy, there being only 20 minutes of bright sunshine during the last five days.

IRELAND.

CORK.—General deficiency of warmth and sunshine and excess of rainfall.

DROMORE.—A most favourable month for vegetation, but the great number of wet days caused much delay in the hay harvest; the potato crop is the finest for thirty years, with scarcely a trace of blight; oat crops very fine.

WATERFORD.—A month of cold, wet, and very unsettled weather throughout; rainfall 1·51 in. above the average of 8 years; blight showing in the potatoes, and hay very difficult to secure; T on 12th and 18th; L on 12th.

KILLALOE.—Rainfall much above the average; mean temp. (60°·6) below it.

DUBLIN, FITZWILLIAM SQUARE.—A changeable, cool, and very showery month, with but little sunshine; at the beginning southerly winds prevailed, but after the 12th it blew most frequently from the north-westward; mean temp. nearly 3° below the average of the previous 18 years; rainfall below the average, but number of rainy days considerably in excess. Distant T heard on the 5th, 13th and 21st, but no severe TS occurred; H fell on 21st.

WARINGSTOWN.—The first fortnihgt though generally warm was wet, heavy T showers being frequent; the latter half was fine and genial, all that could be desired.

EDENFEL.—Although the temp. of the month was low (there not having been one summer's day), and the first half wet, it was on the whole not unfavourable; hay well saved, and all crops promise abundance.

TEMPERATURES OF JULY 16TH AND JAN. 1ST, 1883.

To the Editor of the Meteorological Magazine.

SIR,—The temperature of the 16th instant was the lowest I have yet recorded in the month of July. The shade minimum was 43°·3, and the mean temperature of the day only 52°·1 (11°·4 under the average).

The mean temperature of the 1st January was 53°·0, and the air minimum 50°·7; being respectively 0°·9 and 7°·4 *higher* than on July 16th.

I am, Sir, yours respectfully,

GEO. T. GWILLIAM.

37, Lansdowne Crescent, W., July 31.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCXII.] SEPTEMBER, 1883. [PRICE FOURPENCE, or 5s. per ann post free.

HOW TO KEEP THE CLOCK RIGHT.

To the Editor of the Meteorological Magazine.

SIR,—I see that in the June issue of your *Meteorological Magazine* you speak of the difficulty that there is in getting a cheap and good clock; one that will keep time to a minute a month, you indicate as being sufficient. You suggest that £5 should purchase such a clock, and that very superior work in the train is not required. This latter is an error, as to keep accurate time, not only must the pendulum be accurately compensated, but the work done by the pendulum and the impulse received by it must be constant and equal on both sides.

I have designed an electric clock in which the above requirements are satisfied, as the electricity merely raises and drops a gravity arm on each side of the pendulum alternately, and a clock made by me, with a pendulum consisting of a pine rod and a zinc cylinder, 18 pounds in weight and about 13½ inches long by 2½ in diameter, keeps time to a few seconds a week. I have given all the particulars to G. Cook, 19, Arundel Square, Barnsbury, N., who tells me that he can supply the above from £8.

I remain, yours truly,

H. B. T. STRANGWAYS.

5, Pump Court, Temple, E.C., July 31st, 1883.

[We are delighted with the above letter, because it seems to us (subject of course to correction by those who, like Mr. Strangways, are authorities on the subject) that the letter proves that our requirements can be met at the price which we named.

We suggested that for meteorological purposes, for the registration of the time of earthquake shocks, of auroral phenomena, &c., a clock would suffice which kept time within a minute a month, *i.e.*, 15 seconds per week. Mr. Strangway's clock, with its electrical adjustment, is still more accurate, for probably "a few seconds" implies from five to ten, and it costs only £3 more than we desire.

But we want a £5 clock which can be recommended to our observers, and notwithstanding Mr. Strangway's remarks as to our being in error in stating that "very superior work in the train is not

required," we at present adhere to that view, and we do so in consequence of the experience we are about to record.

About ten years since we purchased, at a farm-house sale in Leicestershire, an old-fashioned 8-day striking clock, 7 feet high, and in an oak case, for £3 10s. Including packing, &c., it cost about £4 delivered in London. It was a very ordinary clock, with of course an iron rod for the pendulum, and no arrangement for giving maintaining power while winding, so that at each weekly winding it lost about three quarters of a minute. A well varnished rod of mahogany was substituted for the iron pendulum rod, and a small weighted lever was so fixed as to give (by pulling a string) maintaining power during winding, and the clock was screwed very firmly to a stout wall. The cost of these alterations was 10s 6d. It has been checked more or less regularly by transit observations ever since, but the record for the first few months of this year will probably be sufficient. It may be well to explain that the following values are not in all cases true to a single second, because the record is not kept in figures, but as a diagram.

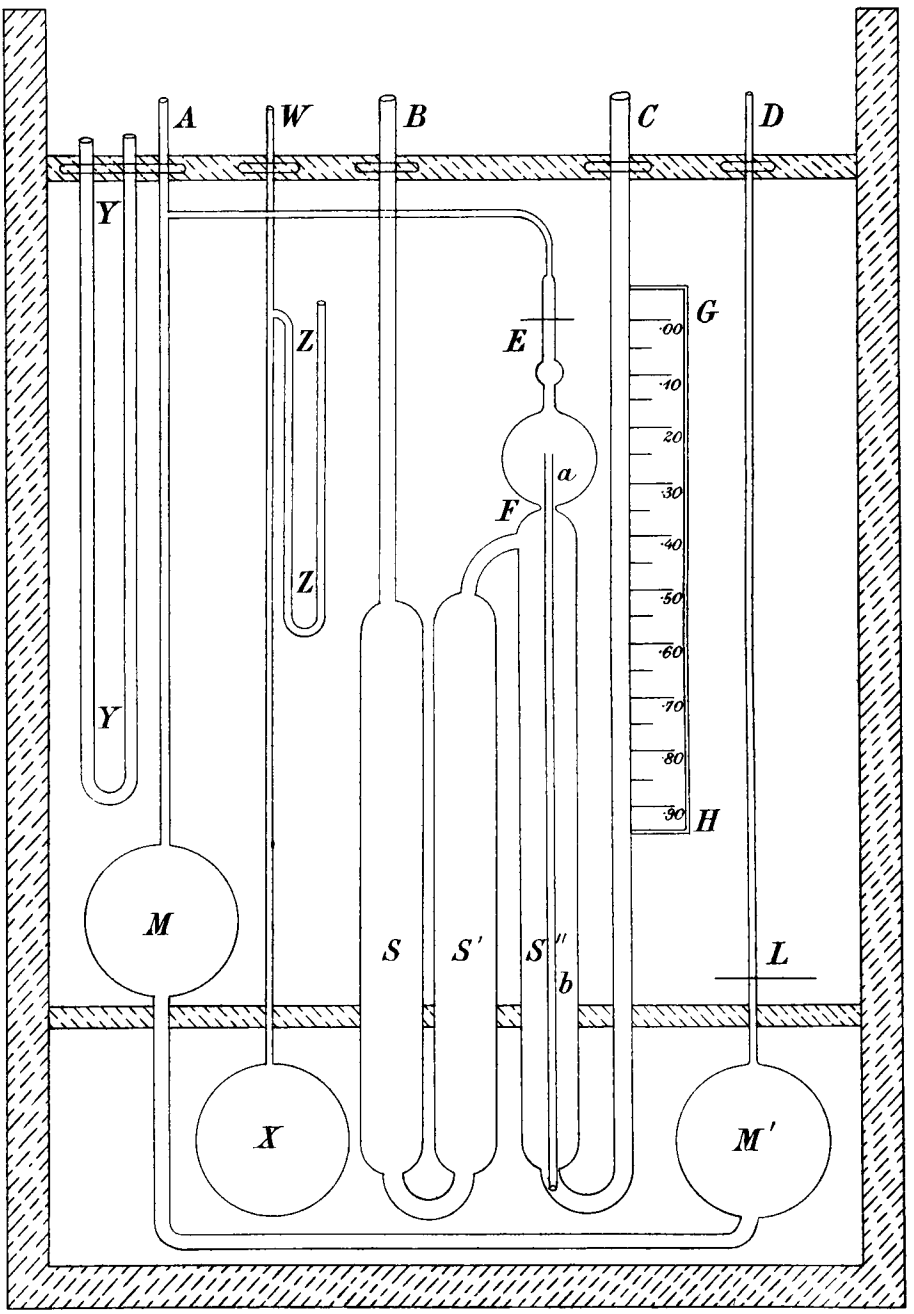
The subject is not of sufficient importance for it to be worth while for us to make systematic transit observations, and, therefore, our practice is to take them occasionally, and to mark them on a diagram, joining all the dots, and so making a continuous curve. The following values are read off from this curve. In the period about to be quoted, the clock had a gaining rate of about 2½ seconds a-day, or one minute in 23 days. This rate is allowed for in the second column, and being allowed for, the residual error in no case exceeds 22 seconds. Is or is not this result proof that very superior work in the train is not required?

	ERROR.		
	Actual.	Due to gaining rate.	Unaccounted for.
	m. s.	m. s.	m. s.
January 1.....	0 0	0 0	0 0
,, 15.....	0 18	0 25	−0 7
February 1..... ..	0 48	1 5	−0 17
,, 15.....	1 23	1 45	−0 22
March 1...	2 15	2 23	−0 8
,, 15.....	2 45	3 3	−0 18
April 1.....	3 22	3 43	−0 21
,, 15	4 3	4 23	−0 20
May 1.....	5 15	5 3	+0 12
,, 15.....	5 50	5 43	+0 7

The clock was away for cleaning during June, and on its return attempts were made to reduce the gaining rate. This has, apparently, been very successful. (Of course it would be absurd to compare any such clock with an astronomer's clock; we are considering only how much accuracy can be got for £5.)

W. H. DINES'S

ATMOSPHERIC VAPOUR METER.



Scale, 4 inches to the foot.

Here are the values from July 25th to September 14th :—

DATE.	ERROR. m. s.	
July 25	0 33	slow.
August 7.....	0 31	,,
,, 15.....	0 28	,,
,, 20.....	0 22	,,
September 8	0 22	,,
,, 14	0 23	,,

This clock has no gravity escapement, no electrical arrangements, nothing (except the 10/6 additions) beyond what may be found in scores of collier's cottages in Northumberland and Durham.

It, therefore, seems to us, that probably as Mr. Strangway's clock *with* the electrical arrangement costs £8, it would cost only £5 without it, and if so, then we have gained half of our object. We have got for £5 a clock which will keep time within a minute a month.

But our other requirement remains ; we want some optician to bring out a cheap and easily-used instrument, for obtaining, either by the sun alone, or preferably by either sun or stars, local time, true to two or three seconds. Who is to have the credit of doing this ?]—ED.

ATMOSPHERIC VAPOUR METER.

To the Editor of the Meteorological Magazine.

SIR,—In accordance with your suggestion, I forward herewith diagram and description of the instrument which has been designed for the purpose of obtaining the tension of aqueous vapour directly. The bulbs MM′ are filled with mercury to the level L, and SS′ with sulphuric acid. Air is forced into S until the acid rises to the mark E, and to the zero mark on the gauge GH, which is on the same level. A tap connected with B (not shown in drawing) is then closed. Next, by forcing air in at D, the mercury in M′ is driven into M, on removing the pressure it falls to the level L, drawing the external air into M. The openings at A and C are then closed. The mercury in M′ is again driven into M, the air meanwhile passing down the tube *a*, *b*, and bubbling up through the acid in S′′. The bulb F still contains some acid, through which the air bubbles on its return, the space between the tubes at F being sufficiently large to allow the air to pass up, although not large enough to have allowed much acid to leak through while the air was passing down the tube *a*, *b*. This process is repeated till the air is dry. The acid is then forced up to E, C is opened, and the loss of pressure noted on the gauge GH. The pressure in M being less than before, the mercury in the tube DL falls below L, and consequently the volume of air in M is less. Allowance is made for this error, which is very small, in graduating the gauge GH, which therefore gives the true tension. The bulbs, &c., are fitted into a wooden frame, with a glass front, filled with water above the level of

M. Any change of pressure or temperature which may occur during the observation is shown by some oil in the bent tube ZZ.

The tube YY, which is partly filled with water, serves to check the readings of the guage GH from time to time, one end of it being temporarily connected with A for the purpose. Between B and the tap attached to it, a T piece and flexible tube containing mercury are introduced; by raising or lowering the free end of the tube the acid may be brought to the mark E with great accuracy. An ordinary air syringe is used for forcing air in, or withdrawing it from B and D. A, C and W are closed by screwing an india-rubber washer on to them. It is advisable to introduce a calcium chloride drying tube between D and the syringe, to obviate the possibility of any moisture reaching the mercury in M. It is just possible that the neglect of this precaution may have made some of my readings too low.

Yours truly,

W. H. DINES.

Burgess Hill.

THE INFLUENCE OF THE WEATHER ON THE FARM CROPS.

To the Editor of the Meteorological Magazine.

SIR,—The Government will probably, at no distant day, entertain the suggestion, which has been repeatedly made, of estimating the yield of the crops per acre. It was done in Scotland for a period of years, and but for a small hitch, it would have been continued. It is done annually in Ireland, and the *Mark Lane Express* did it last year, and is again receiving returns from its numerous correspondents in the counties with a view to publication. It is impossible to say what number of bushels of wheat, barley, oats, &c., are grown on an acre in a given locality, but certainly a near approximation can be made by a skilled farmer in the district.

We think that the aid of the meteorologist would be very serviceable in such an undertaking, for the crops are very much what the weather makes them. A cold wet summer is always followed by a deficient harvest and *vice versa*. The reason why the attempts hitherto made to collate the weather and the crops have more or less failed, is, we think, because few have studied their relations with the requisite skill. In fact, it is only now that the farmer is beginning to attach any significance to the records of the meteorologist. Again, the farmer finds that crops do not yield according to appearance, and on that point the thermometric conditions of the earth and air would assist him.

The influence which the weather exerts upon the crops cannot be very easily determined, and it can only be done by taking the temperature and rainfall with minor details for a series of years, and comparing them with the produce of these years on several classes of soils. The months of June, July, and August are mainly to be con-

sidered. There is nothing easier than ascertaining the temperature and rainfall, and their averages; but averages are not enough, there may be a succession of hot days followed by extreme cold. The cold days may do more than neutralize the hot, and who shall value such abnormal conditions? Every person is at present speaking of the promising appearance of the crops, but who can tell how much the extreme cold of the sixteen days of July (13-28) has detracted from their value. We learn that at Braemar the temperature fell to 27° on the morning of the 28th; and at Gordon Castle, the seat of the Duke of Richmond and Gordon, in Banffshire, the mean temperature of these sixteen days was under 53°. This station is about three miles from the sea, and stands at an altitude of 70 feet above the ocean's level. These low temperatures were accompanied by an extra rainfall and northerly or north-westerly winds, and crops made little progress.

Again, at the Cardington Observatory, in the plains of Bedfordshire, a similar condition of the weather is reported, for during these sixteen days the mean temperature was 56°, while the average mean temperature for the month of July, at that station for a long series of years, is 63°. The good weather in the first part of that month and of the concluding days increased the mean temperature, but it was considerably below par. In these cold days some families lighted their room fires on several evenings, and apprehensions are naturally felt as to the influence on the corn crops, which might be expected, when the mean temperature of both June and July was below 60°.

I am, Sir, yours truly,

DAVID ROBIE.

Bedford, 2nd August, 1883.

ON SIMULTANEOUS TEMPERATURES AT DIFFERENT HEIGHTS.

To the Editor of the Meteorological Magazine.

SIR,—In your paper on Temperatures at different heights, you refer to the observations of Six taken at various parts of the tower of Canterbury Cathedral about a century ago, and then pass on to Mr. Main's observations made in 1861. As far as my reading extends, the first continuous set of observations on these comparative temperatures was by M. Pictet, of Geneva, in the year 1779. He noticed that a thermometer suspended 5 ft. from the ground marked a lower temperature on clear nights than one suspended at a height of 75 ft. His object was to ascertain the law of cooling in a vertical column of air. For this purpose he erected a mast in an open plain, with simple arrangements for quickly raising and lowering the thermometers. He also placed a thermometer with its bulb buried in the earth near the foot of the mast, a circumstance which caused him to miss a great discovery; for had he simply placed the bulb on the earth instead of burying it, this acute observer would have

anticipated the true theory of dew; for he would have found that on clear nights the earth's surface is colder than the air above it, whereas he supposed it to be warmer. Passing over a number of interesting results, it may be stated that the readings of the two thermometers at 5 and 75 ft. were alike at about 2 or 2½ hours after sunrise, and continued so during the hottest part of the day; but some time before sunset, the lower thermometer marked a lower temperature than the upper one, the difference increasing rapidly until sunset, and averaging as much as 2° Reaumur, and even more as long as twilight lasted. This difference continued up to 11 o'clock at night, and apparently until sunrise; and not till some time after sunrise did the readings agree, and then they began to cross each other as before. This result was obtained at all seasons, during moderate wind, and in cloudy weather; only in the last case the effect was much less appreciable. When the sky was completely clouded, or fog prevailed, or much wind, the difference disappeared, and the readings of the two thermometers were identical.

Pictet had always supposed the cold of evening to descend from above, and even Sir John Leslie, who died in 1832, always referred the cause of dew to "cold pulses rained from the sky." Pictet says he could scarcely believe his eyes when he found a thermometer at the height of 75 ft. to be more than 2° Reaumur higher than one at 5 ft., and the thermometer hanging at four lines from the ground giving generally a lower reading than one at 5 ft.

The observation with which Wells is generally credited as to the different temperatures on the ground and in the air was, I imagine, first made by Professor Alexander Wilson, of Glasgow, in January, 1768, who noticed that a thermometer placed on the snow marked a temperature 8° F. lower than one suspended in the air. His son, Professor Patrick Wilson, has recorded a multitude of experiments commencing in 1780, in the course of which he constantly found that in clear weather the ground at night is colder than the superincumbent air. He also correctly described the effect of screens, and even made use of the gauze screen associated with the name of Wells. Wilson also attached a thermometer to a hook at the end of a long pole, and raised it to a height of 24 ft.; when, on suddenly lowering the instrument, he was surprised to find a higher reading that at the station below, which marked 10° F.

Mr. Six also, writing in 1783, correctly refers the temperature at the upper station to proceed from a refrigeration which takes place on the surface of the ground in the evening and night, and more particularly so when the weather is still and clear. M. Prevost, of Geneva, in 1792, correctly expounded the doctrine of radiant heat in lowering the temperature of the earth and the action of clouds in limiting radiation.

The whole history of the theory of dew will be found in an essay of mine published in January, 1861, in the *Edinburgh New Philoso-*

phical Journal, and also in a little volume published in Weale's Series in 1863, entitled *Experimental Essays*.

I remain, Sir, sincerely yours,

CHARLES TOMLINSON.

Highgate, N., 17th August, 1883.

[We are glad that an omission, for which we cannot account, has led to the receipt of the above interesting summary. In the *Proceedings of the Royal Society*, the following sentence was inserted because there had not been time to epitomize M. Pictet's experiments. In the reprint in the *Met. Mag.* the words in italics were left out:—"The Author is not aware of any further experiments having been made upon this subject *in this country* until 1861."—ED.]

THE GALE OF SEPTEMBER 1ST.

To the Editor of the Meteorological Magazine.

SIR,—We had a heavy S.S.E. gale in the evening of the 1st inst., veering to S. at 1 a.m., S.S.W. at 6 a.m., and S.W. at 9 a.m. on the 2nd, with a rapid and great fall of the bar. from 29·528 in. (corrected for temp. and height) at 9.14 a.m. on the 1st, to 28·591 in. at 9.14 a.m. on the 2nd, being the lowest observed since December 20th, 1876. The max. velocity of the wind was 45 miles, from 4 to 5 a.m. on the 2nd. The sea and tide were very high in Tor Bay at 6 p.m. on 1st, and 6.30 a.m. on 2nd, and great damage has been done by the rain (0·79 in. on 1st) and wind to the outstanding crops and in orchards.—Believe me, yours sincerely,

Kirkham, Babbacombe, Torquay, Sept. 3rd, 1883. E. E. GLYDE.

SIR,—The gale of September 1st–2nd, 1883, has had the same effect on vegetation as that of April 29th, 1882. The phenomena described in *Met. Mag.* vol. xvii. pp. 65–70, have been reproduced, but the mischief done is *much greater*. I shall esteem it a favour if you will inform me whether meteorologists are yet decided as to the cause of trees, &c., being *scorched* and withered after the gale on the side exposed to the wind. Our maximum wind force here was 10, by estimation.—Yours very truly,

St. Aubin's School, Jersey, Sept. 8th, 1883. J. E. VIBERT.

SIR,—We have had since yesterday morning a heavy south gale, with torrents of rain. Such a severe gale I have not witnessed since the 1st September, 54 years ago. The bar. fell to 28·50, and remained at that low point many hours. It is now, 9.30 a.m., slightly rising. My rain, registered at 9 a.m., was 1·52 in.

The gale began at 10 a.m. yesterday. The London telegram at 10 p.m. on Friday for this district (No. 8) was—"Westerly winds, light to moderate; fair on the whole; some showers." Alas for weather forecasts! Have we yet made one step in advance? I trow not.—Very sincerely yours,

JAMES LIDDELL.

Bodmin, September 2nd, 1883.

LIGHTNING FIGURES.

[We are indebted to Mr. R. Strachan for calling our attention to the following paragraph, the italicised portion of which is remarkably opportune in its bearing on the recent Scottish photograph.—ED].

LIGHTNING ATTACKING AN EDITOR.

LIGHTNING appears to be no respecter of persons, as that American editor who recently had an encounter with a bolt of lightning found out. The gentleman in question, Mr. H. M. Burt, the editor of *Above the Clouds*, published at the Summit House, Mount Washington, New Hampshire, writes to a friend in Hartford, Connecticut, that he was in his office at about six in the evening on July 28th, when he felt a tremendous blow in the back. He states further:—"I could not imagine at first what caused it, but instantly thereafter I saw a ball of fire, as large as a man's head, in front of me, not three feet off. It exploded with a tremendous noise, seemingly as loud as a cannon, and then I knew what must have happened. My left leg seemed to be completely paralysed, and I fell to the floor. Three of my printers were in the room at the time, two sitting at the table near me, and one standing up a little further off. The latter had the skin on one hand torn up, another was hit in the back, and the third escaped without injury. We are glad to be able to record that Mr. Burt gradually recovered from the temporary paralysis induced by the electric stroke. He winds up his account by saying:—"*You have probably heard of the impression of a tree being found upon the bodies of those killed by lightning. The same thing was noticed upon my back, and, as there are no trees upon Mount Washington, it seems to me that the peculiar appearance must be the result of the blood settling in the smaller veins.*" We give the above story with all due reserve. But if it should be true in all its details, and not partly the outcome of the effects of a natural phenomenon on an imaginative brain, the visitation was probably sent as a terrible warning by Jupiter, the God of Thunder—and of "Thunderers," we suppose—to one of the latter tribe to be more sparing in the application of the editorial electric flash in future.—*Iron.*

DESTRUCTIVE LIGHTNING FLASH.

THE *Petersburger Zeitung* reports the destructive action of a flash of lightning which struck the stable attached to the cavalry officers' school at Krasnoje-Selo, killing sixteen horses on the spot. The electric fluid, on striking the corner of the building, seems to have travelled along the iron with which the racks were covered, and set all the hay on fire at once. The horses all fell to the ground. Most of them rose again quickly; but sixteen were found to be dead and two were quite deaf. In all the horses that were killed, the electric fluid seems to have entered at the head or the neck, passing down through the fore feet. The killed horses were not all together, or in adjoining stalls, but were scattered up and down the stable, justifying the presumption that their death was caused by their coming into contact with the metallic covering of the racks. The horses who survived were most probably not in contact with the metal at the moment when it was being traversed by the electric fluid.—"*Public Opinion*," *August 18th, 1883.*

BURSTING OF A WATERSPOUT ON THE OCHILS.

YESTERDAY afternoon, between four and five o'clock, a waterspout of unprecedented magnitude burst on the Ochils between Dollar and Alva. The most serious effects were felt in Alva, where a great deal of property was destroyed. The outflow commenced at Alva burn, and within a quarter of an hour the

principal street was in flood, some parts being fully three feet under water, which carried in its course large quantities of goods from the shops and mills. Passing through Green Square, a complete wreck was made of Mr. Perry's bakery and of the Post Office on the other side of the street. Further down, the factory of Messrs. J. Henderson and Son and Mr. J. Porteous, were nearly wrecked, the workers being knee deep in water. A new workshop belonging to Mr. Chas. Thomson, Burnbrae, was swept away. The middle bridge leading to the glen was also washed away, and here a man had a narrow escape from drowning. The upper bridge was so much shaken that the passage over it was prohibited. Several of the factories will be unable to resume work for weeks. The flood came on so suddenly that people who had crossed the street only three minutes before had almost to swim back to their houses. From a baker's shop five bags of flour and casks of butter were floated a distance of 100 yards. Never will those who witnessed the sudden inundation and its effects forget the scene.

Tillicoultry did not suffer so much, although tons of boulders were washed into the streets from the hills.—"*The Dundee Advertiser*," *August 3rd, 1883.*

AN EXTRAORDINARY METEOR.

THE most remarkable fall of an aërolite that has yet been recorded took place at Lachine, about eight miles from Montreal, on Saturday, July 7th. The following account is from the Montreal *Daily Star* of July 11th :—"The fall of the aërolite transpired during a rain shower on the forenoon of Saturday, and there were no premonitory indications to show that the air was more than usually charged with electricity. The person who witnessed the fall of the aërolite more clearly than anyone else was Mrs. Popham, wife of Mr. Popham, insurance agent. Mrs. Popham was seated upstairs in her house, sewing, when all of a sudden the apartment became illuminated with a blinding flash of light. The lady instantly glanced out of the window, when to her astonishment she beheld a huge mass of fire descending towards the earth in a diagonal direction. This brilliant body had a solid nucleus that appeared to the eye about four feet square, and a strange indescribable noise was caused by its flight through the air. Simultaneously, as it seemed to Mrs. Popham, she received a paralysing shock that affected her from head to foot, as if the entire contents of a highly-charged battery had been discharged into her body at once. The astonishing brilliancy of the meteor caused a temporary loss of sight, and it was fully half an hour before the lady could distinguish surrounding objects.

"When Mrs. Popham first beheld the falling mass she fancied that it was about to strike the house, and is still of the opinion that it must have passed alarmingly close. The lady took several hours to recover from the shock, and when Mr. Popham returned home, several hours after, he found her partially prostrated from its effects. Mr. McNaughton, a brother of Mrs. Popham, was sitting downstairs, reading, when the flash came. He jumped up, and, looking out of the window under the trees towards the river, he plainly saw the fiery ball strike the water at a little distance from the shore, causing a mountainous upheaval and sending splashes in every direction. Mr. Horace Baby also saw the glare caused by the flight of the meteor, although he did not actually see the body itself. He said that he felt a tremendous shock, and that he could feel the electricity oozing out of his finger-ends for some time after. Mr. C. P. Davidson, Q.C., was sitting down to lunch at the time, and describes the crash as being tremendous. The Rawlings family also felt the shock severely, as indeed did half the village. Mr. Popham's cottage stands about seventy feet from the water's edge at Stony Point, and it is thought that the aërolite fell into the stream about twenty or thirty yards from the shore in about twenty feet of water. Owing to the high winds since the occurrence the water has been so muddy that it has been impossible to locate the whereabouts of the meteor. An attempt, however, will shortly be made to bring it to the surface.—"*The Colonies*," *August 10th, 1883.*

ON THE CLIMATE OF THE BRITISH EMPIRE DURING 1882.

THE Climatological Tables which have appeared for nearly two years in this Magazine were, as many of our readers are aware, previously published in *The Colonies*, the series commencing with January, 1874; we have, therefore, similar data for nine years, and although absolute uniformity of instruments and exposure is impossible, and would be unsuitable under such extremely varied conditions as prevail in the different Colonies, our readers may be satisfied that the observations accurately represent the climates of the various stations, and are capable of strict comparison one with another.

The following table gives an epitome of those which have appeared monthly, as well as some data especially computed for it, and leads to the following conclusions:—

The two stations which have the unenviable distinction of dividing between them the greatest number of extremes of the various elements during 1882, are Adelaide and Winnipeg, Manitoba.

Adelaide had the highest shade temp., the highest temp. in sun, the smallest rainfall, and the driest atmosphere.

Winnipeg had the lowest temp. in shade, the greatest range of temp., and the lowest mean daily temp.

Although the max. shade temp. at Adelaide, 112°·0, has more than once been exceeded, the max. in sun, 180°·0, appears to be unusually high, and far exceeds that of any Indian station; the rainfall, 15·74 inches, is also small, though not unprecedentedly so.

The minimum temperature at Winnipeg, —39°·7, is rather high for that station, the average being about —45°, while in 1879 the extreme reading of —50°·5 was registered, which is more suggestive of the records of a voyage of Arctic discovery than of a return from a regularly inhabited district. The great range of temperature at this station must be very trying, its max. during 1882 being 90°·1, nearly ten degrees above that of London and only two or three degrees below those of Bombay and Ceylon, while the total range during the nine years is 145°·5, from 95°·0 to —50°·5, the range at London during the same period being 82°·8 only, not a great deal more than half as much.

Mauritius and Barbados run each other very close for the distinction of the most equable temperature, for while the mean daily range at the former was 8°·5, at the latter it was 8°·8, whereas, if we take the extremes, the case is reversed, Mauritius having a total range of 28°·2, while at Barbados it was only 20°·0.

The greatest rainfall recorded during the year was 79·63 in. at Ceylon, an amount to which no special interest can attach, as it is exceeded not only in many parts of the British Isles, but at numerous places in all the continents of the world; for even in Australia there are records of nearly or quite that amount at one or two stations in Queensland, and of values of 60 inches or thereabouts, on the shores of the Gulf of Carpentaria.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1882.

STATIONS.	Absolute.				Average.					Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.										
	°		°		°	°	°	°		°	°	in.		
England, London	80·8	Aug. 6	24·5	Dec. 12	58·3	43·1	50·7	43·7	80	130·0	19·4	27·14	165	6·6
Cape of Good Hope	105·7	Feb. 14	33·8	Sep. 1	74·6	51·8	58·2	54·2	75	...	...	29·29	84	...
Mauritius	86·4	Jan. 21	58·2	June 29	78·5	70·0	74·2	64 6	73	...	...	56·06	209	5·7
Calcutta	101·5	April 26	51·6	Feb. 6, 9	86·7	70·2	78·4	69·7	77	161·7	38·5	66·18	123	4·6
Bombay	94·3	Feb. 25	63·2	Feb. 18	85·5	74·2	79·8	71·5	76	151·1	52·3	69·23	105	3·8
Ceylon	92·5	...	67·6	Dec. 13	86·3	75·5	80·9	71·6	73	157·0	58·0	79·63	159	6·6
Melbourne	110·5	Jan. 19	31·5	June 9	67·8	49·2	58·5	46·3	68	168·9	24·4	22·28	131	5·6
Adelaide	112·0	Jan. 18	34·5	July 17, 28	73·0	53·1	63·1	47·6	58	180·0	27·5	15·74	134	5·0
Wellington	79·0	Nov. 24 & Dec. 24	36·0	Aug. 18	61·2	49·8	55·5	...	...	142·0	30·0	55·69	166	...
Auckland	80·0	Mar. 7	35·6	Aug. 20	65·9	52·8	59·3	51·6	76	...	31·0	45·44	191	6·6
Falkland Isles	69·1	Dec. 16	19·5	June 5	47·7	37·1	42·4	39·0	85	134·2	17·7	30·41	235	7·3
Jamaica	92·2	Aug. 27	61·5	Feb. 6	86·4	71·2	78·8	70·4	78	...	...	20·33	...	4·3
Barbados	86·0	Oct. 21	66·0	Mar. 30	80·9	72·1	76·5	71·6	80	156·0	...	48·01	187	6·0
Toronto	89·9	July 26	−17·4	Jan. 24	53·2	37·5	45·3	38·6	74	145·0	−23·0	24·83	158	6·4
Cape Breton, Sydney	84·5	Aug. 5	−12·8	Mar. 16	48·6	32·5	40·5	36·3	83	...	...	61·20	177	6·5
Manitoba, Winnipeg	90·1	Aug. 27	−39·7	Jan. 23	45·3	23·7	34·5	30·9	80	...	...	24·49	107	4·9

SUMMARY.

Highest temperature in shade, 112°·0 at Adelaide on January 18; Lowest temperature in shade, —39°·7, at Winnipeg, on January 23.
Greatest range in year, 129°·8, at Winnipeg; Least range in year, 20° at Barbados.
Greatest mean daily range, 22°·8, at Cape of Good Hope. Least mean daily range, 8°·5, at Mauritius.
Highest mean daily temperature, 80°·9, at Ceylon. Lowest mean daily temperature, 34°·5, at Winnipeg.
Driest station, Adelaide, 58. Dampest station, Falkland Isles, 85.
Highest temperature in sun, 180°·0, at Adelaide.
Greatest rainfall, 79·63 inches, at Colombo, Ceylon. Least rainfall, 15·74 inches, at Adelaide.
Most cloudy station, Falkland Isles; average amount, 7·3. Least cloudy station, Bombay; average amount, 3·8.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1883

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	57·0	31	22·4	24	44·9	30·4	31·4	83	101·4	19·3	·86	11	5·4
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	86·1	14*	68·4	7	83·4	73·5	69·7	76	...	...	4·99	14	6·6
Calcutta	97·4	25	60·3	17	88·9	69·3	66·8	71	153·1	48·3	1·52	6	3·4
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	90·5	31	66·6	12	84·5	71·9	68·0	70	143·7	59·9	·00	0	1·6
Ceylon, Colombo	90·6	12	71·8	14	88·8	74·6	71·3	71	156·0	69·0	5·61	10	4·3
Melbourne	98·0	18	46·0	6	76·1	55·5	53·3	69	161·0	37·0	4·15	11	5·6
Adelaide	101·6	17	46·7	21	81·6	58·2	48·0	46	174·0	39·6	·89	8	4·4
Wellington	77·0	4	45·0	25†	68·7	54·5	...	...	139·0	41·0	5·56	11	...
Auckland	78·5	3	53·0	20	73·5	61·1	58·7	74	131·5	...	2·59	18	6·1
Falkland Isles	60·8	15	29·1	30	50·8	39·2	42·0	87	119·6	24·0	5·34	23	7·7
Jamaica, Kingston	87·6	31	64·6	5	84·2	69·0	69·3	82	...	58·3	2·57	...	3·5
Barbados	83·0	29	73·0	28	79·0	70·0	68·3	76	146·0	66·0	1·36	10	5·0
Toronto	46·1	14	—5·8	22	31·2	11·8	17·5	74	128·5	—14·5	2·36	14	5·6
New Brunswick, S.John	44·0	20‡	—10·0	6	30·4	15·2	23·2	91	...	...	6·18	17	6·3
Cape Breton, Sydney	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	41·3	13	—28·7	20	18·7	— 9·4	5·5	78	115·0	...	·24	3	4·5
British Columbia, Yale	59·5	15	7·2	2	44·8	22·3	...	...	...	...	·31	4	4·4

* And 18 † And 26. ‡ And 27.

REMARKS, MARCH, 1883.

Mauritius.—Rainfall 2·58 in. and temp. 0°·1 below the average; mean pressure 29·963 in.; mean hourly velocity of wind 9·1 miles, extremes 26·2 miles and 1·8 mile; prevailing direction E.S.E. to E.N.E.; T and L on 6th to 8th, 14th to 20th, and on 21st. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on 11 days, L was seen on three other days, and T was heard on three other days.

Melbourne.—Mean pressure, mean temp. of air and of dewpoint, mean humidity, rainfall and amount of cloud, all above the average; rainfall very considerably, but pressure, humidity and cloud only slightly; prevailing direction of wind S. to W., strong breezes occurring on six days; heavy dew frequent; dense fog on 15th; T and L on 24th, 25th and 30th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure 30·090 in. slightly above the average; mean temp. 0°·8 below the average, the max. reaching 90° on seven days; rainfall ·32 in. below average. C. TODD.

Wellington.—Weather generally fine till 10th; strong wind and 2·83 in. of R on 12th; then generally fine again till towards the end of the month; mean pressure slightly above, and mean temp. below the average; rainfall nearly double the average; slight earthquakes on 21st and 28th. R. B. GORE.

Auckland.—Weather at commencement and end of month fair but showery in the middle; bar. high, mean 30·188 in.; strong N.E. gale with heavy R on 11th; average velocity of wind 251·7 miles per diem. E. B. DICKSON.

Falkland Isles.—A wet month, snow on 29th and 31st. F. E. COBB.

BARBADOS.—Mean temp. 73°·9, same as the average of 25 years; prevailing wind N.E., average velocity 11·4 miles per hour, extremes 15·7 miles and 6·8 miles; rainfall below the average; evaporation above it. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Rain.
		in.			in.
II.	Dorking, Abinger	·82	XI.	Llanfrechfa Grange	1·98
,,	Margate, Birchington...	·49	,,	Llandovery	2·64
,,	Littlehampton	1·32	,,	Solva	1·23
,,	St. Leonards	·67	,,	Castle Malgwyn	1·38
,,	Hailsham	1·16	,,	Rhayader, Nantgwillt..	2·91
,,	I. of W., St. Lawrence.	·73	,,	Carno, Tybrith	3·49
,,	Alton, Ashdell.....	1·14	,,	Corwen, Rhug	1·63
III.	Winslow, Addington ...	·83	,,	Port Madoc	4·28
,,	Oxford, Magdalen Col...	·70	,,	I. of Man, Douglas	3·76
,,	Northampton	1·09	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	·84	,,	Melrose, Abbey Gate ...	2·53
IV.	Southend	·28	XIII.	N. Esk Res. [Penicuick]	4·15
,,	Harlow, Sheering	1·12	XIV.	Ayr, Cassillis House ...	6·13
,,	Diss	·68	,,	Glasgow, Queen's Park.	4·21
,,	Swaffham	1·08	XV.	Islay, Gruinart School..	5·71
,,	Hindringham	1·65	XVI.	St Andrews, Newton Bk	2·69
V.	Salisbury, Alderbury...	1·03	,,	Aberfeldy H.R.S.	...
,,	Warminster	1·96	,,	Dalnaspidal H.R.S. ...	6·82
,,	Calne, Compton Bassett	1·40	XVII.	Keith H.R.S.	5·61
,,	Beaminster Vicarage ...	1·31	XVIII.	Forres H.R.S.	3·96
,,	Ashburton, Holne Vic..	1·82	,,	Strome Ferry H.R.S....	7·74
,,	Torrington, Langtree W.	...	,,	Lochbroom	6·79
,,	Lynmouth, Glenthorne.	1·71	,,	Tain, Springfield.....	3·56
,,	Probus Lamellyn	1·33	,,	Loch Shiel, Glenaladale	10 49
,,	Taunton, Fullands	1·12	XIX.	Lairg H.R.S.	3·92
VI.	Bristol, Clifton	2·38	,,	Forsinard H.R.S.	3·72
,,	Ross	·81	,,	Watten H.R.S.	2·93
,,	Wem, Sansaw Hall.....	1·51	XX.	Fermoy, Glenville	5·18
,,	Cheadle, The Heath Ho.	2·10	,,	Tralee, Castlemorris ...	4·07
,,	Worcester, Diglis Lock	·91	,,	Tipperary, Henry Street	3·83
,,	Coventry, Coundon	·93	,,	Newcastle West	4·32
VII.	Melton, Coston	2·93	,,	Kilrush	...
,,	Ketton Hall [Stamford]	·91	,,	Corofin	5·06
,,	Horncastle, Bucknall ...	1·59	XXI.	Carlow, Browne's Hill..	4·13
,,	Mansfield, St. John's St.	1·54	,,	Navan, Balrath	2·15
VIII.	Macclesfield, The Park.	2·69	,,	Athlone, Twyford	5·41
,,	Walton-or-the-Hill.....	2·49	XXII.	Mullingar, Belvedere ...	3·37
,,	Lancaster, South Road.	3·12	,,	Clifden, Kylemore	5·23
,,	Broughton-in-Furness ..	...	,,	Crossmolina, Enniscoe..	...
IX.	Wakefield, Stanley Vic.	1·50	,,	Carrick-on-Shannon ...	3·80
,,	Ripon, Mickley	1·21	XXIII.	Dowra	...
,,	Scarborough.....	1·22	,,	Rockcorry.....	3·35
,,	East Layton [Darlington]	1·79	,,	Warrenpoint	4·36
,,	Middleton, Mickleton ..	3·07	,,	Newtownards	5·95
X.	Haltwhistle, Unthank..	4·14	,,	Belfast, New Barnsley..	6·20
,,	Shap, Copy Hill	3·50	,,	Bushmills	5·56
			,,	Buncrana	5·48

AUGUST, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·93	— 1·81	·39	8	10	82·7	21	46·9	20	0	0
II.		Maidstone (Hunton Court)...	·50	— 1·74	·12	8	7	...	...	...	...	...	...
,,		Strathfield Turgiss	·59	— 1·83	·27	31	12	81·0	21	41·8	20	0	0
III.		Hitchin	·80	— 1·48	·20	31	10	74·0	21	44·0	23	0	...
,,		Banbury	·98	— 1·72	·27	31	14	78·0	13	42·0	1	0	...
IV.		Bury St. Edmunds (Culford)	1·47	— ·70	·53	31	12	79·0	13	41·0	16*a*	0	..
,,		Norwich (Cossey)	·70	— 1·92	·21	31	8	83·7	13	41·0	17	0	...
V.		Bridport	·79	...	·26	7	12	...	..	...	...	...	...
,,		Barnstaple.....	2·29	— 1·81	·61	6	16	78·0	25*b*	52·0	3	0	..
,,		Bodmin	1·44	— 3·40	·28	14	21	72·0	21	48·0	12	0	0
VI.		Cirencester	1·00	— 2·66	·34	8	14	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	1·56	— 2·52	·53	8	12	72·5	25	46·0	9	0	0
,,		Tenbury (Orleton)	·86	— 2·86	·13	8	13	75·7	13	39·7	23	0	0
VII.		Leicester	1·16	...	·30	8	13	79·3	13	44·0	23	0	0
,,		Boston	1·30	— 1·31	·80	8	10	82·0	13	45·0	17	0	...
,,		Grimsby (Killingholme).....	1·37	— 1·55	·62	8	17	74·0	13	48·0	19*c*	0	...
,,		Hesley Hall [Tickhill].....	1·01	...	·38	8	13	78·0	25	39·0	19	0	...
VIII.		Manchester (Ardwick).....	3·53	— ·39	1·32	9	16	77·0	13	47·0	12	0	...
IX.		Wetherby (Ribston Hall) ...	1·29	— 1·34	·71	9	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·38	— 1·42	·96	14	18	78·0	22	43·0	2	0	...
X.		North Shields	2·64	— ·45	·65	15	12	73·5	14	42·5	12	0	0
,,		Borrowdale (Seathwaite).....	11·33	+ ·29	1·49	7, 9	21	71·2	24	42·9	12	0	...
XI.	WALES.	Cardiff (Ely).....	2·68	— 2·65	·83	14	15	...	...	...	...	...	...
,,		Haverfordwest	2·34	— 2·63	·90	8	18	72·0	24	27·5	23	1	1
,,		Plinlimmon (Cwmsymlog) ...	5·36	...	1·10	8	20	...	...	...	...	...	...
,,		Llandudno.....	1·82	— 1·37	·37	14	13	69·0	25*d*	48·8	24	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	4·53	+ ·26	1·29	12	18	70·2	2	41·8	12	0	...
,,		Hawick	3·22	— ·68	·91	12	12	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	5·34	+ 1·04	1·28	12	12	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	6·54	+ 1·32	1·39	9	21	...	...	...	...	...	...
,,		Appin (Airds)	6·91	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	6·17	...	·92	7	27	...	...	...	...	...	.
XVI.		Loch Leven Sluices	4·30	+ ·22	...	...	...	...	...	...	...	...	...
,,		Arbroath	2·94	— ·39	·58	12	13	70·0	24	45·0	12*e*	0	...
XVII.		Braemar	5·18	+ ·75	·71	9	20	69·0	25	40·3	8	0	2
,,		Aberdeen	3·77	...	·91	13	14	71·0	25	43·0	17	0	0
XVIII		Skye (Sligachan)	10·35	...	1·65	8	24	...	...	...	...	...	...
,,		Culloden	2·96	— ·04	·45	1	10	69·0	25	44·0	23	0	0
XIX.		Dunrobin	4·24	...	·64	13	17	69·2	25	43·0	19	0	...
,,		Orkney (Sandwick).....	3·15	+ ·25	·70	11	21	63·8	25	41·6	13	0	0
XX.	IRELAND.	Cork (Blackrock)	4·63	+ ·80	1·61	12	12	84·0	25	41·0	17	0	0
,,		Dromore Castle	8·44	...	2·78	12	25	70·0	24*f*	43·0	7	0	...
,,		Waterford (Brook Lodge) ...	4·25	...	2·32	12	16	71·0	8*i*	42·5	16*j*	0	...
,,		Killaloe	6·54	...	2·27	12	17	78·0	26*g*	43·0	14	0	...
XXI.		Portarlington	3·51	+ ·44	·91	12	17	73·0	23	46·0	11	0	...
,,		Dublin (FitzWilliam Square)	3·31	+ ·13	1·04	6	14	71·4	26	48·0	12	0	0
XXII.		Ballinasloe	4·48	+ ·45	1·38	12	19	65·0	27	42·0	12	0	...
XXIII.		Waringstown	3·03	— ·41	1·41	12	15	78·0	24	43·0	11*h*	0	0
,,		Londonderry (Creggan Res.).	5·33	...	1·29	12	22	...	...	...	...	...	...
,,		Omagh (Edenfel)	5·07	+ 1·42	2·23	12	19	70·0	25	42·0	15	0	...

+ Shows that the fall was above the average ; — that it was below it.

a And 23. *b* And 26. *c* And 24 *d* And 26. *e* And 31. *f* And 25. *g* And 27. *h* And 31. *i* And 22, 23. *j* And 25.

METEOROLOGICAL NOTES ON AUGUST.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A seasonable, fine month, with remarkably good harvest weather; all crops are excellent.

BANBURY.—The last three weeks of the month were very favourable for harvest operations, and much corn was secured in good condition; mean. temp. of the month 60°·1; high wind on 13th, 14th, and 15th.

CULFORD.—The weather was most propitious for the ingathering of the harvest, which was nearly concluded at the end of the month; refreshing rains occurred at intervals.

COSSEY.—A fine harvest month; fog on 19th, 23rd, 24th and 25th.

BODMIN.—Mean temperature of the month 60°·9; 1°·1 below the average.

CIRENCESTER.—This is the first August for several years with a rainfall below the average.

WOOLSTASTON.—A favourable month for harvest operations, the grain crops maturing with great rapidity in the third week, and being secured in good condition in many districts by the end of the month. Mean temperature of the month 59°·1.

ORLETON.—A variable sky with a low temp., much cloud, and frequent falls of R prevailed till the 12th; the remainder of the month was very fine and dry with much sunshine, and a higher temperature; in every way favourable for ripening the grain crops. The max. temp. was above 70° on 18 days, but only reached 75°·7, and the mean temp. of the month was about a ¼ of a degree below the average of 22 years. Very distant T was heard on the 9th, but no L was seen during the month.

LEICESTER.—The first half of the month was rather unsettled, although no heavy R fell; the second half was very dry and fine, no R falling between the 15th and 27th. Much corn cut and some carried.

KILLINGHOLME.—A very fine harvest month; a good deal of corn carried in the last week; potatoes sounder than for several years; apples a good crop. T and L, with high wind on 8th; T on 14th.

MANCHESTER.—The beginning of the month was promising, but the weather broke about the 7th, and became rough and stormy, heavy rains damaging the crops; it then became more settled as the month advanced, and the temp. rose, which benefited the crops greatly. The temp. of the month, however, was below the average. Heavy TS on 8th; T on 30th.

NORTH SHIELDS.—TSS on 2nd and 10th; T on 14th and 15th.

SEATHWAITE.—Stormy with heavy R from 7th to 9th; 4·27 in. of R falling during the three days; 3·89 in. also fell during the three days 12th to 14th.

WALES.

HAVERFORDWEST.—The summer as a whole was not favourable: there were very few hot days, and a great absence of sunlight, and it was at times stormy and frequently close and relaxing. There were a few fine sunshiny days during the last fortnight of August, but although the rainfall of the month was below the average, the number of days on which R fell rendered it very hindering to the harvest. Rivers and brooks unusually low.

LLANDUDNO.—Though the mean temp. was nearly 3° below the average, August was on the whole a fine month, and most seasonable for the cereals and green crops; there was a fair amount of sunshine (152·3 hours), and the temp. was very steady, the mean daily range being only 10°·7, and the total range during the month 20°·2. Began to cut oats on 14th, and wheat and barley on 16th.

SCOTLAND.

CARGEN.—Mean temp. of the month 2°·3 below the average; duration of sunshine also much below the average; very stormy and wet from 12th to 15th; T on 10th.

HAWICK.—A fine genial month; harvest operations commenced towards the close; very severe TS on 10th.

QUINISH.—A very wet gloomy month, with remarkable absence of sunshine; nearly all the hay which was not secured in July rotted on the ground; corn crops are badly laid, but potatoes are free from disease.

ABERDEEN.—Fairly good weather throughout the month, rainfall slightly above the average; squally and wet from 7th to 10th; L on 30th; T, L, R and H on 31st.

CULLODEN.—Temp. of the month low, but the weather as a whole was fair; no R fell between the 14th and 25th.

SANDWICK.—August was colder, wetter and more cloudy than the average, so the ripening of the crops was retarded and harvest was not begun at the close of the month.

IRELAND.

CORK.—The early part of the month was abnormally wet, but after the 14th no R fell, and fine harvest weather prevailed for a fortnight; no TS.

DROMORE.—The month gave an epitome of all weather, fog, mist, rain, storm, sunshine, and high temp. all occurring. On the 8th occurred the heaviest rainfall for several years (1·68 in.), but the 12th exceeded anything on record, 2·78 in. falling in less than 12 hours during a calm with high temp. Hay crop plentiful but injured; oats a heavy crop but much laid; potatoes better than for the last 30 years, which, occurring after a wet summer with high temp., is against the theory of meteorological causes of the disease.

KILLALOE.—Considerable loss of hay on low-lying lands, and injury to bridges resulted from the unusually heavy R of the 12th. The splendid weather of the latter part of the month effected a marked improvement in the appearance of all crops; harvest very late, reaping only commenced on 30th.

DUBLIN.—The first half of the month was unsettled, with heavy rains and high winds; after the 14th there was a decided improvement, and the second half of the month was dry, comparatively bright and warm. The mean temp. (58°·6) was as nearly as possible equal to the average of 18 years. Violent TSS occurred in the evening and continued late into the night on the 6th, the L being very vivid, and accompanied by torrents of R (1·04 in. fell in less than two hours). With this exception, no electrical disturbance was recorded at Dublin, but on the 9th L was seen over the sea.

WARINGSTOWN.—A very fine month; crops of all descriptions most promising.

EDENFEL.—With the exception of the second week the weather of the month was fine and favourable, although without much heat or sunshine. Between 2 p.m. on 12th and 9 a.m. on 13th there occurred the heaviest rainfall for at least 20 years, viz, 2·23 in. followed in the next 48 hours by 1·37 inches. Crops heavy, but harvest not commenced at the close of the month.

ONTARIO.—On the night of August 22 a hurricane swept through the Ottawa Valley, doing great damage to barns, fences, and crops in the country districts. Two barns were fired by the lightning, many trees blown down, and the telegraph poles laid flat in most parts of the course of the storm. One man received bad injuries.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCXIII.] OCTOBER, 1883. [PRICE FOURPENCE, *or 5s. per ann. post free.*

THE BRITISH ASSOCIATION AT SOUTHPORT.

THE meeting at Southport was not merely a great success as regards the numbers attending it, but in that of the influential members present. As regards Meteorology, the following list shows that the attendance was exceptionally good :—

Adams, Prof., J.C., F.R.S.	Cambridge.
Barrington, R. M.	Fassaroe, Wicklow.
Bateman, J. F., C.E., F.R.S.	Westminster.
Black, W. J., F.M.S.	Edinburgh.
Capper, R.	Swansea.
Capron, J. R., F.M.S.	Guildford.
Chadburn, A.	Sheffield.
Chambers, C., F.R.S.	Bombay.
Chambers, C., jun.	Bombay.
Chapman, T. A.	Hereford.
Copeland, R., Ph.D.	Dunecht.
Crewdson, Rev. G.	Kendal.
Crowley, F., F.M.S.	Alton.
Edge, T. L. K., F.M.S.	Strelley Hall, Nottingham.
Edmonds, F. B., F.M.S.	London.
Evans, J., D.C.L., Treas. R.S., F.M.S.	Hemel Hempsted.
Fordham, H. G.	Royston.
Fox, C.	Kingsbridge.
Galton, Capt., C.B., F.R.S., F.M.S.	London.
Galton, Francis, F.R.S.	London.
Glaisher, J., F.R.S., F.M.S.	Greenwich.
Healey, G.	Windermere.
Hughes, G. P.	Wooler.
Latham, Baldwin, C.E., F.M.S.	London.
Laughton, J. K., Pres. M.S.	Greenwich.
Lowe, E. J., F.R.S., F.M.S.	Chepstow.
Mackeson, H. B., F.M.S.	Hythe.
Maclear, Capt., R.N., F.M.S.	Cranleigh.
Mellish, H., F.M.S.	Hodsock Priory, Worksop.
Muirhead, H., M.D.	Cambuslang.
Nelson, R. J.	Kendal.
Pengelly, W., F.R.S.	Lamorna, Torquay.
Perry, Rev. S. J., F.R.S., F.M.S.	Stonyhurst.
Roberts, Isaac	Liverpool.
Scott, Prof. A. W.	Lampeter.
Shaw, H. S. Hele, F.M.S.	Clifton.
Sidebotham, J. W.	Erlesdene, Bowden.

Siemens, Sir W., F.R.S., F.M.S. ...	London.
Smelt, Rev. M. A., F.M.S.	Cheltenham.
Smith, B. Woodd, F.M.S.....	Hampstead.
Southall, J. S.	Ross.
Stanley, W. F., F.M.S.	South Norwood.
Stewart, Prof. Balfour, F.R.S., F.M.S.	Manchester.
Symons, G. J., F.R.S., Sec. M.S.....	London.
Taylor, T.....	Aston Rowant, Tetsworth.
Twamley, C..... ..	Coventry.
Verney, Capt., R.N., F.M.S.	Bangor.
Ward, T.	Blackpool.
Wilson, T., F.M.S.....	Harpenden.

Among the papers read were the following :—

Report of the Committee on Underground Temperature.

Report of the Committee on the Underground Waters of England and Wales.

Report of the Committee on Meteoric Dust.

Report of the Committee appointed to co-operate with the Scottish Meteorological Society, in making Meteorological Observations on Ben Nevis.

SIR J. E. ALEXANDER.—*The Evils arising from the Pollution of Rivers.*

W. G. BLACK.—*Description of a Marine Anemometer.*

J. RAND CAPRON.—*On some points in Lemström's recent Auroral Experiments in Lapland.*

BALDWIN LATHAM.—*The Influence of Barometric Pressure on the Discharge of Water from Springs.*

PROFESSOR LÜROTH.—*On Measuring the Height of Clouds.*

I. ROBERTS.—*On the Attractive Influence of the Sun and Moon in causing Tides, and the variations in atmospheric pressure and rainfall, causing oscillations in underground waters in porous strata.*

PROFESSORS ROSCOE AND BALFOUR STEWART.—*On the Heat of Sunshine at Kew Observatory, as registered by Campbell's method.*

PROFESSOR BALFOUR STEWART AND W. LANT CARPENTER.—*On apparent Sun Spot Inequalities of short period.*

G. J. SYMONS.—*On the Completion of the European portion of the Preliminary Meteorological Catalogue.*

UNDERGROUND WATER.

Ninth Report of the Committee for investigating the Circulation of Underground Waters in the Permeable Formations of England, and the Quantity and Character of the Water supplied to various Towns and Districts from these Formations. Report drawn up by C. E. DE RANCE.

Ten years having elapsed since the Committee was appointed at Belfast, they think this a fitting opportunity to review the results already obtained, and to point out what additional information they consider to be still required, in the hope that they may receive assistance in their investigations from the various local societies or from individuals who may be disposed to aid in the work. The work intrusted to the Committee was twofold—first, to inquire into the circulation of underground waters in permeable formations ; secondly, to ascertain the quantity and quality of the water supplied to towns and districts from these formations. The information obtained occupies nine reports ; the eight already published fill up no less than 163 pages of the annual volumes of the Association, and contain a record of upwards of 500 wells and borings. The

Committee believe that the publication of these results, by directing public opinion to the value of such supplies, and by the preservation of the records of those carried out, has given an impetus to water of this class being generally adopted for domestic consumption in districts where gravitation supplies are unsuitable or unattainable. As regards the first head of inquiry—the circulation of underground water—much remains to be learnt, especially as to the influence of variation of barometrical pressure on the volume of springs. Independent investigation is now being carried on by Mr. Baldwin Latham, but it is exceedingly desirable that numerous observations should be taken in different classes of rocks, the quantity of water a rock is capable of holding, being no measure of the quantity of water it is capable of yielding. The difference of the period of time in which two rocks will absorb, and give off by gravity, the same quantity of water is governed by the difference of their chemical composition. The chemical composition of two rocks being identical, their facility of discharge of water is in direct relation to the amount by which they are traversed by planes of joints and fissures, and the extent these may run parallel or at right angles to the valleys which cut into and expose the water-bearing beds. The proportion of the annual rainfall that is absorbed by different classes of rocks is a subject that requires further examination. The quantity is largely regulated by the quantity stored from previous years. After a succession of dry years the permanent water-level is reduced to a minimum, the water gradient becomes nearly flat and the springs cease to flow. The first heavy rains will be nearly wholly absorbed, until the maximum water-gradient is reached and the rocks are stored with the largest amount of water they can hold. After they are once charged, all excess of rainfall runs off in floods, and the amount absorbed is practically *nil.* Spread over the twelve months, the annual amount absorbed is probably never more than 15 in., and the average ranges from 5 in. in chalk countries, to 10 in. in new red sandstone areas. In millstone grit districts about 8 in. are absorbed, but the permeable beds are thin, and the water is thrown off again in numerous springs, as a rule in the same drainage basin, giving permanence to the dry-weather flow of the streams traversing them. Except in *waterworks drainage areas* few observations exist as to the actual volumes run off daily by the rivers of this country, and data on this subject are much required, as well as a permanent record of the height to which floods rise in the various river basins. Further observations are required as to the action of faults in acting as ducts, along the face of which water is constantly passing, and barriers separating districts into distinct drainage areas. The facts hitherto obtained point to faults traversing thick permeable sandstone and limestone, having these formations on both sides of the dislocation, as offering no obstacle to the free passage of waters, which, even if locally obstructed by the hardened face or slickenside jointing of the fault, invariably finds its way through cracks extending across the width of the fault, while in faults traversing shales and clays of any age, the fissure, be it wide or narrow, always appears to have been filled with the impermeable material forming the sides, and in some cases, when porous rocks have been immediately overlaid by impermeable material since denuded, the fissure of the fault has been filled from above at a time when the fault had an upward prolongation, destroyed with the denuded material referred to. The daily registration of the heights of the streams might easily be made on gauges, painted on the county bridges, but the organization necessary to carry this out is entirely beyond the scope of the British Association, and should be carried

out at the national charge, being of the highest importance to the country. The determination of the number of cubic feet of water carried down at selected points on the English rivers, particularising whether it represents *dry-weather, average,* or *flood-flow,* would be of very high value, and might well be undertaken by the Association. Such observations, stating the run-off per square mile of drainage area and the geological character of the area drained, would have more than a *local* value. Permeable rocks below the permanent water-level of a district may be regarded as a reservoir of which the cubic content is limited by the size of the spaces between the grains, and the width of the fissures and cracks by which the rock may be traversed. The quantity of water such rocks are capable of storing has had much light thrown upon it by the investigations of Mr. Wethered, published in the fourth appendix to our eighth report.

METEORIC DUST.

The report of the committee on "Meteoric Dust" was presented by Prof. A. Schuster, who delivered a verbal address, in the course of which he said that a committee was appointed four or five years ago to see primarily whether there was any meteoric dust to be found, and, secondly, to examine it. He had only to present a few specimens of meteoric particles which had been found in the snow of the Himalaya mountains. Of these those present could judge for themselves as to the probability of their being meteoric or not. These contained a quantity of spherical particles of iron which must at one time have been in a state of fusion, so as to have taken the spherical shape or the shape of a drop. These specimens came from a height of 13,400 ft., and the nearest hut from the spot where they were found was at a distance of fourteen miles, so that they were very far removed from any place where iron was likely to be found. The whole work of the committee had been in examining these specimens.

ON THE EVILS ARISING FROM THE POLLUTION OF RIVERS.

By Gen. Sir J. E. Alexander, C.B., F.R.S.E.

THE author has been for a long period a member of the Association for the preservation from pollution of the Rivers and Lochs of Scotland, and also of the Council of the Scotch Fisheries Improvement Association, and therefore takes deep interest in the above question.

One great impediment to the improvement of rivers arises from the owners of woollen and paper mills obtaining high rents from tenants who pollute the streams. The proprietor knows that if the tenant is interfered with his own income will be jeopardised, and therefore he allows the injurious pollution to continue.

The author is of opinion that members of both Houses of Parliament should take up the question of anti-pollution energetically, frame laws, and *see them put in force by the Government,* to preserve our valuable waters for the health of the people and the production of fish.

INFLUENCE OF THE SUN AND MOON ON THE LEVEL OF UNDERGROUND WATER.

On the Attractive Influence of the Sun and Moon in causing Tides, and the Variations in Atmospheric Pressure and Rainfall, causing oscillations in the underground waters in porous strata.

By Isaac Roberts, F.G.S., F.R.A.S.

The investigations have been made at Maghull, which is an agricultural district, about 8 miles to the N.E. of Liverpool, and relate to movements in the underground water of the Triassic rocks which lie beneath the surface of the ground. The water in these rocks is by capillarity, made to form an inclined plane towards the sea, which at Maghull has its surface at 60 ft. above mean sea level. The surface of the water plane was shown to be in a state exceedingly sensitive to the following influences, namely :—

Atmospheric Pressure,
Lunar Attraction,
And Solar Attraction.

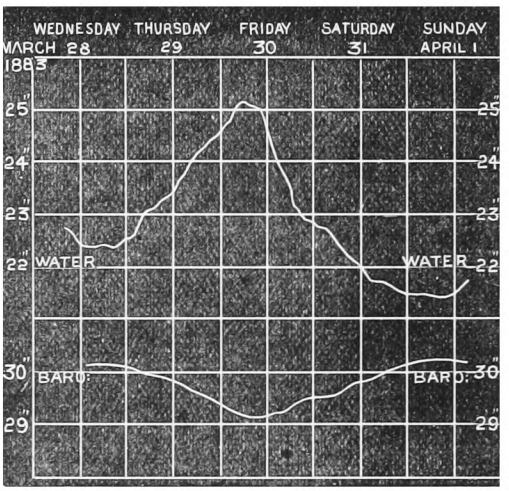
In order to determine the relative extent of these and other disturbing influences upon the water plane, an artesian well was sunk in the Triassic rocks, to a point below mean sea level, and the rise and fall of the column of water, 60 ft. in height, freed from the friction in the rock, was used as the means of registering those disturbances in the water plane, by using a mechanical contrivance of a float and drum (caused to revolve by clock-work), to trace a curve upon the diagram paper.

The curve showed the extent, from moment to moment, of the atmospheric variations, and also the effects of the attraction of the Sun and Moon upon the water plane, in producing oscillation in the first case, and true semi-diurnal lunar and solar tides in the latter case.

The effect of the rainfall was also shown on the diagram.

It was also shown that there were intervals when all the forces which have been named above were in equilibrium, the water plane remaining in a state of perfect quiescence during those periods.

The diagram shows the effects of the atmospheric disturbance which occurred between the 28th March and 1st April, 1883. The lower curve shows the variations in the barometrical pressure and the upper curve the simultaneous movements in the underground water. It will be observed on comparing the curves, that between noon and 8 o'clock on the 28th March, the underground water was nearly steady at 22·4 in., and the barometer was also nearly steady at 30·1 in. On the 30th, at 5 o'clock in the morning, the underground water had risen to 25·18 in., and at 8 o'clock the same morning, the barometer had fallen to 29·1 in., thus showing that a fall of 1 in. in the barometric pressure had affected the level of the water underground to the extent of 2·75 in. The diagram showed



many similar coincidences of this character, besides those which are traceable to rainfall, and to lunar and solar attraction.

A new field of enquiry appears to be opened out by these investigations, and the author is still steadily pursuing them, as he has done for several years past and the full result of his studies in these directions may be looked for shortly.

THE HEAT OF SUNSHINE.

On the heat of sunshine at Kew and London, as shown by Campbell's sunshine recorder.

By Professors Roscoe and Balfour Stewart.

After describing Campbell's arrangement of mahogany bowls, into which the sun burned a mark by means of a lens, the results obtained by the observations made were thus stated by the authors :—

(1). The yearly value of sunshine at Kew is greater than that at London, in the rate of 100 to 58.

(2). The half-yearly value at both places is greater for the half-year between the summer and winter solstice than for that between the winter and summer solstice, this difference being more marked for London than for Kew.

(3). As far as the authors can judge from the limited number of observations at their disposal, the heat of sunshine is greater at times of maximum than at times of minimum sun-spot frequency. At the same time there is an indication of another subsidiary maximum —this forming a double terrestrial period corresponding to a single period of sun spots.

SUN SPOT INEQUALITIES.

On sun spot irregularities of short periods.

By Prof. Balfour Stewart and W. Lant Carpenter, Esq.

The authors described a method of detecting unknown inequalities

in a mass of observations, and stated that (reserving the question of *true* or *apparent* periodicity) there were strong evidences of the existence of two separate sun-spot inequalities of periods not far different from 26 days. It was shown that each appeared as nearly as possible in the same place and with the same range for three series of twelve years each, viz., 1832-43, 1844-55, 1856-67, these embracing all the observations at the authors' disposal.

The average value of these inequalities may be represented by regarding the mean sun-spot value as 1,000, in which case this would become less than 900 at the minimum period of the inequality, and greater than 1,100 at its maximum period.

It is believed by the authors that these inequalities have definite representatives in terrestrial temperature range.

ON THE COMPLETION OF THE EUROPEAN PORTION OF THE PRELIMINARY METEOROLOGICAL CATALOGUE.

By G. J. SYMONS.

THE author commenced by giving a few illustrations of the large amount of time and energy which has been wasted by meteorologists owing to their not knowing what had previously been done, sometimes even in their own country, but most frequently in other parts of the world; and he pointed out that with the modern development of meteorological work and of meteorological literature, some effort, upon a large scale, to deal with this evil was imperatively necessary.

Mr. Symons described the catalogue which he had formed during the last 20 or 25 years, by extracting (from many thousand catalogues issued by dealers in second-hand books in most of the capitals of Europe) all the titles of works on meteorology or kindred subjects. He also described the important publication, by the Royal Society, of its *Catalogue of Scientific Papers*, and showed wherein the two agreed, and how largely each supplemented deficiencies in the other.

He then explained the steps which Prof. Cleveland Abbe had taken in preparing his card catalogue, and the arrangements whereby a copy of Mr. Symons' catalogue was to be prepared and forwarded to the United States for incorporation with Prof. Abbe's.

Mr. Symons then stated the additions which had been made to the original proposal, and that the following catalogues had been subsequently incorporated, each giving *approximately* the number of titles set against it, viz. :—

Prof. A. Poëy's	MS.	6,000
Ronald's	Printed	3,000
Struve's Pulkova	Printed	3,000
Meteorological Society	MS., and printed	2,000
Houzeau's Belgian	Printed	2,000
Soc. Météor de France	MS.	1,500
Royal Observatory, Greenwich.	MS.	500
Fineman's Swedish	Printed	500
	Total about	18,500

Of course a great many of these were duplicates, but every catalogue contained titles which were not in any of the others, and altogether they have undoubtedly added very largely to the value of the work; it is impossible to state how largely, nor is it material in a case wherein the assistance rendered has been almost as great as the catalogue, and as diverse as the languages dealt with.

The precise number of titles forwarded is not known, but is probably about 20,000. Prof. Abbe's catalogue is understood to contain about 10,000, but probably there will be a few thousand common to both catalogues, and therefore the preliminary catalogue, which the United States Signal Office, under the direction of General Hazen, will proceed to prepare for publication, will probably contain the titles of more than 25,000 books and papers upon meteorology.

Mr. Symons remarked, in conclusion, that the catalogue must not be regarded as complete. It was impossible to make it perfect—it could not be perfect as regarded the past until every public and private library in the world had been searched. It could not be perfect for the present, because every day new works appeared in different parts of the world, and all could not be simultaneously inserted. Nor would his part of it bear bibliographical criticism, for he was not a bibliographical expert, and his chief aim had been to give information useful to working meteorologists.

HOW TO KEEP THE CLOCK RIGHT.

To the Editor of the Meteorological Magazine.

SIR,—In the letter published in your September number, and headed "How to keep the clock right," from H. B. T. Strangways, Esq., and your note annexed thereto, the need of a clock capable of keeping a certain limit of rate, and produceable at, say £5, is fully expressed; but the real difficulties in the way of carrying out so desirable an end are not fully apprehended. The opinion that "very superior work in the train is not required" is certainly correct; the true performance of the clock will depend almost entirely upon the use of a weight and not a mainspring, and upon a properly proportioned and constructed pendulum; the other portions of the clock may be of a comparatively rough-and-ready kind. The difficulty of producing the clock for £5 really lies in the cost of the case; the pendulum must be a certain known length in order to beat seconds, and the weight must have a certain fall to keep the clock going eight days; if, therefore, the pendulum, and the weight during the whole length of fall, are to be enclosed in the case, it would be out of the question to produce the clock at the proposed price; but if it be acceded that the movement and dial need alone be enclosed, and the pendulum and weight left uncased in, we are quite prepared to make the clock at the proposed price of £5, and guarantee the result of a maximum error of 15 seconds a week.

In the matter of a cheap transit instrument, that just produced

under the auspices of Mr. Latimer Clark, with his very valuable tables, is just to your point, or if sun alone be taken, a Dent's dipleidoscope.—Yours truly,

JOHN ALEXANDER LUND,

Managing Director, The Standard Time and Telephone Company.
19 *and* 21, *Queen Victoria Street, E.C.*.

To the Editor of the Meteorological Magazine.

SIR,—The prominence that you have given to my last letter leads me to think that a few more remarks on clocks may not be unacceptable.

My electric clock is driven, not merely controlled, by electricity, and the action is quite independent of any variation in the current; the electricity keeps the pendulum in motion, and the clock train merely acts as a counter to record the number of the beats of the pendulum. For battery I use a modification of Cromwell Varley's gravity Daniel; the cells require attention about once a month, consuming in that period about a pound of sulphate of copper. I made this clock myself, with the exception of turning and boring the long pendulum bob, and fitting the small ratchet wheel and step by step motion to the dial works, which latter consist of a half-guinea American clock. The whole of my outlay on the clock was about £4, and there is no reason why any one who is tolerably handy with the tools should not make one for this sum, as I would readily let any one introduced by you, take the measurements of the various parts. I sent some particulars of this clock to the Astronomer Royal, who replied that the action appeared to be somewhat similar to that of the solar mean-time clock at the Greenwich Observatory.

Your old-fashioned eight day clock is not an answer to my statement, that "to keep accurate time, not only must the pendulum be accurately compensated, but the work done by the pendulum and the impulse received by it must be constant and equal on both sides." No doubt the accuracy of a clock depends chiefly on the pendulum, but the most accurately compensated pendulum cannot keep time if driven by a jerky train. The old eight-day clocks were generally very well made; in many of them the work was as good as that put into a considerable proportion of the modern "regulators;" therefore I am not at all surprised at the good performance of your clock; but you cannot buy such a clock new for £3 10s., the case alone would cost nearly double the money; and when these old clocks get into the hands of London men, they break them up. I have seen nearly half a cart-load in a clockmaker's loft in Clerkenwell. Some time ago, Horne and Thornethwaite, the opticians, tried to bring out a reliable clock at a moderate price, but they could not do it at a very low price, and the few who would pay the sum they had to charge were generally able to pay the further amount necessary to obtain a first-class clock. I do not know where such a clock as you require can be got new for £5; the nearest approach is the Vienna Regulator, beating seconds, and which can be seen at nearly all the co-operative

stores. If any one should offer to supply for £5 such a clock as you seek, I advise your readers to order one at once, as I am sure the supply will not continue long, or the quality will fall off, unless the maker is unusually patriotic and superior to all considerations of £. s. d.

A transit instrument, sufficient for your stated requirements, ought to be supplied for £5, if twenty or more were ordered; at present the nearest approach will be found in Dent's dipleidoscope.

I remain, your obedient servant,

H. B. T. STRANGWAYS.

5, *Pump Court, Temple, E.C., Oct. 2nd*, 1883.

[Although each of our correspondents object to some of our conditions, we consider that our aim has been reached. For Mr. Lund's only difficulty is in the case, and the case is not the clock, and its pattern and material may well be left to the option of purchasers. We believe that a neat case could be made of seasoned stained pine, 1 in. thick, and about 6ft. by 1ft. 6in. by 9in., with hinges and lock, for £2; and recommend their general adoption. It would probably strengthen Mr. Lund's position, and certainly tend to the general good, if some of our readers would order them at once, and think that they will not only be doing wisely from a scientific point of view, but also from a commercial one.

We yield to no one in our admiration of Mr. Latimer Clark's transit instrument, but we think that something rather lower in price is desirable.

We only recorded the performance of our clock in support of our opinion that "very superior work in the train is not required;" it is just such a clock as Mr. Strangways says the London men break up, and yet the results were what we gave. However, as Mr. Lund says that our opinion was correct, we are content there to leave that matter.—ED.]

SOLAR HALOES.

To the Editor of the Meteorological Magazine.

SIR,—Yesterday afternoon I saw a fine display of solar halos on a sheet of cirro-stratus travelling from N.N.W. from 4.10 to 4.30 p.m.; of which I append a sketch made at 4.15 p.m.

The small halo, A, was $22\frac{1}{2}°$ in its semi-diameter, the large one, B, 45°. The prismatic colours were bright, especially those of the intersecting arcs C and D, which had the green inside, reversing the order in the rings A and B.

The smaller halo disappeared at 4.17 p.m., but the highest arc, D, was very bright from 4.25 to 4.30 p.m., when the whole display was covered by intervening clouds. At 4.10 p.m. (3rd) the barometer (reduced to 32° and sea level) read 30·094 in., the dry bulb ther-

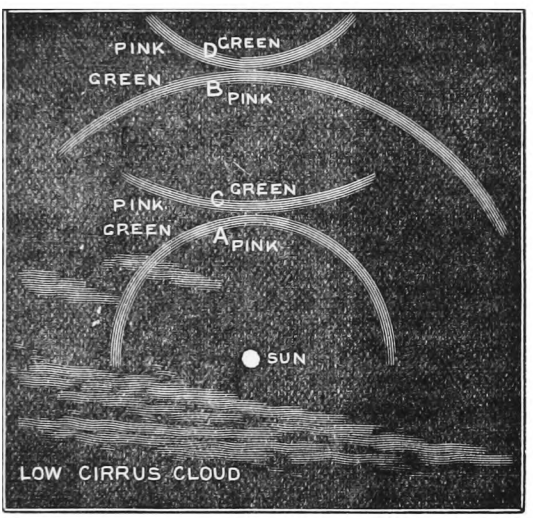
mometer 52°·7, wet bulb 48°·8, and the wind was N.N.W., force 2. The barometer has fallen rapidly since yesterday, the wind has backed to W.S.W. and blows strongly, and ·02 in. of rain fell last night,

Yours sincerely,

EDWIN E. GLYDE.

Kirkham, Babbacombe, Torquay, Oct. 3rd, 1883.

P.S.—Heavy rain has fallen since noon, amounting at 3 p.m. to 0·35 in., and it is now, 3.30 p.m., raining again, with a very cold wind. H fell at 0.33 p.m.



A CAPE HAILSTORM.

An extraordinary violent hailstorm is reported from Graaf-Reinet, where the hailstones are said to have been as "large as oranges," and to have lain "some inches deep." Besides breaking windows and beating down the crops and doing other damage generally expected of heavy hailstorms, this particular visitation is said to have broken down the branches of large trees, killed several ostriches, smashed the roofs of several sheds, and knocked down two or three men. On one farm at Galgenbosch it is said that thirty ostriches were killed outright, and many others injured. It would be interesting to know if the locality in question is subject to heavy hailstorms, and, if so, whether the forests have lately been cut down in the neighbourhood; for the experience of *savans* in Switzerland is that hailstorms are most severe where forest denudation has been most complete.—*Colonies, July 6th.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1883.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	68·9	5	29·3	9	58·7	38·9	38·1	70	94·2	35·7	1·56	9	5·9
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·7	3	66·1	20	81·1	72·1	69·5	80	...	...	12·22	19	5·9
Calcutta	99·5	9	69·5	28	93·8	75·0	73·8	74	154·8	62·3	2·96	7	3·1
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	92·5	17	72·8	5	88·5	77·6	74·8	76	144·5	64·2	·00	0	1·5
Ceylon, Colombo	92·0	4	72·8	7	89·1	76·4	72·7	72	155·7	68·0	8·83	17	6·1
Melbourne	84·7	2	45·2	26	71·5	51·7	49·6	68	141·6	39·3	·95	6	5·6
Adelaide	93·3	1	48·4	23	74·9	55·6	48·5	54	155·0	38·9	2·53	11	4·7
Wellington	69·8	14	41·0	25	60·5	49·2	...	...	133·0	39·0	4·32	18	...
Auckland	71·5	9	45·0	18	66·5	53·6	53·4	79	131·8	...	9·94	23	6·9
Falkland Isles	56·7	10	24·3	18	47·5	36·3	40·5	91	119·0	26·2	3·30	23	8·0
Jamaica, Kingston	88·8	7	66·8	17	85·4	70·5	69·5	75	...	60·4	·28	4	3·9
Barbados	82·0	24	69·0	var.	80·0	71·0	70·3	77	149·0	66·0	2·55	15	6·0
Toronto	64·6	15	11·9	2	46·8	29·6	30·6	69	122·5	5·0	2·54	9	6·5
New Brunswick, S. John	49·0	18	15·0	1	42·0	29·3	31·7	83	...	...	1·84	10	5·8
Manitoba, Winnipeg	62·8	26	—3·2	1	43·1	23·5	27·8	76	128·0	...	·76	9	4·8
British Columbia, Yale	75·5	26	19·4	14	56·7	29·9	...	...	...	...	·45	11	5·5

REMARKS, APRIL, 1883.

Mauritius.—Rainfall 6·12 in. above the average; mean temp. 0°·5 below it; mean pressure 30·010 in.; mean hourly velocity of wind 9·9 miles, extremes 25 miles and 2·4 miles; prevailing direction E.S.E. to E. by N.; T and L on 11 days; floods on 17th to 19th. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on every day except the 10th and 11th.

Melbourne.—Mean temp. of air above the average; mean pressure, temp. of dew-point and humidity about the average; amount of cloud and total R both below it; prevailing direction of wind N.E. and N., strong breezes occurring on 7 days; heavy dew on 11 days, fog on 25th, lunar halos on 15th and 20th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (30·168 in.) about the average of 26 years; mean temp. slightly above the average, though the ther. only once registered 90°. Rainfall nearly 1 in. above the average, but very unevenly distributed, nearly 2 in. falling on 2nd, while after the 10th scarcely any fell; from 8th to end of the month the bar. did not once fall below 30 in. C. TODD.

Wellington.—Generally unpleasant, squally, and showery till the 18th; stormy on several days; from 19th to 27th fine, though dull at times, with light winds, chiefly easterly; last three days showery; fog on 27th and 28th; Mean temp. 2°·3 below the average R. B. GORE.

Auckland.—Rainfall excessive, more than three times the average, and falling on twice the average number of days; 2·33 in. fell each day on 10th and 11th; mean temp. 2°·3 below the average; mean pressure (30·078 in.) almost identical with the average; T on 15th and 16th. E. B. DICKSON.

BARBADOS.—Mean temp. (74°·8) 0°·8 above the average of 25 years; prevailing direction of wind N.E.; rainfall 4 per cent. above the average; evaporation 11 per cent. above it; slight shock of earthquake on 2nd. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·69	XI.	Llanfrechfa Grange	7·09
,,	Margate, Birchington...	3·11	,,	Llandovery	4·71
,,	Littlehampton	4·89	,,	Solva	4·99
,,	St. Leonards	3·84	,,	Castle Malgwyn	4·70
,,	Hailsham	...	,,	Rhayader, Nantgwillt..	8·73
,,	I. of W., St. Lawrence.	4·36	,,	Carno, Tybrith	8·54
,,	Alton, Ashdell.....	4·23	,,	Corwen, Rhug	...
III.	Winslow, Addington ...	4·74	,,	Port Madoc	6·03
,,	Oxford, Magdalen Col...	4·50	,,	I. of Man, Douglas	9·21
,,	Northampton	4·66	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	4·38	,,	Melrose, Abbey Gate...	4·64
IV.	Southend	...	XIII.	N. Esk Res. [Penicuick]	3·50
,,	Harlow, Sheering	2·92	XIV.	Ayr, Cassillis House ..	3·65
,,	Diss	3·66	,,	Glasgow, Queen's Park..	3·47
,,	Swaffham	5·84	XV.	Islay, Gruinart School..	3·20
,,	Hindringham	6·27	XVI.	St.Andrews,NewtonBk	3·30
V.	Salisbury, Alderbury...	3·76	,,	Aberfeldy H.R.S.	1·28
,,	Warminster	4·17	,,	Dalnaspidal H.R.S. ...	5·09
,,	Calne, Compton Bassett	3·98	XVII.	Keith H.R.S.	5·62
,,	Beaminster Vicarage ...	7·50	XVIII.	Forres H.R.S.	2·78
,,	Ashburton, Holne Vic..	10·06	,,	Strome Ferry H.R.S....	3·26
,,	Torrington,LangtreeW.	...	,,	Lochbroom	3·94
,,	Lynmouth, Glenthorne.	5·59	,,	Tain, Springfield.....	2·90
,,	Probus, Lamellyn	5·95	,,	Loch Shiel, Glenaladale	6 37
,,	Taunton, Fullands	3·52	XIX.	Lairg H.R.S.	3·10
VI.	Bristol, Clifton	4·48	,,	Forsinard H.R.S.	3·47
,,	Ross	4·52	,,	Watten H.R.S.	4·04
,,	Wem, Sansaw Hall.....	5·45	XX.	Fermoy, Glenville	6·37
,,	Cheadle, The Heath Ho.	6·56	,,	Tralee, Castlemorris ...	3·60
,,	Worcester, Diglis Lock	4·56	,,	Tipperary, Henry Street	5·36
,,	Coventry, Coundon	5·41	,,	Newcastle West	4·07
VII.	Melton, Coston	5·46	,,	Kilrush	...
,,	Ketton Hall [Stamford]	5·90	,,	Corofin	3·40
,,	Horncastle, Bucknall ...	5·34	XXI.	Carlow, Browne's Hill..	4·53
,,	Mansfield, St. John's St.	5·76	,,	Navan, Balrath	2·00
VIII.	Macclesfield, The Park.	5·64	,,	Athlone, Twyford	4·09
,,	Walton-on-the-Hill.....	5·39	XXII.	Mullingar, Belvedere ...	4·29
,,	Lancaster, South Road.	4·90	,,	Clifden, Kylemore	...
,,	Broughton-in-Furness ..	6·44	,,	Crossmolina, Enniscoe..	4·90
IX.	Wakefield, Stanley Vic.	4·80	,,	Carrick-on-Shannon ...	4·45
,,	Ripon, Mickley	4·61	XXIII.	Dowra	...
,,	Scarborough.....	3·97	,,	Rockcorry.....	3·74
,,	EastLayton[Darlington]	3·82	,,	Warrenpoint	5·14
,,	Middleton, Mickleton ..	4·88	,,	Newtownards	3·73
X.	Haltwhistle, Unthank..	5·46	,,	Belfast, New Barnsley..	5·80
,,	Shap, Copy Hill	4·74	,,	Bushmills	5·98
			,,	Buncrana	5·19

SEPTEMBER, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·83	+ 1·33	·65	29	18	75·3	18	41·4	23	0	0
II.		Maidstone (Hunton Court)...	3·42	+ 1·11	·53	20	17	...	...	...	...	..	...
,,		Strathfield Turgiss	3·09	+ ·79	·65	29	14	72·8	18	36·4	9	0	1
III.		Hitchin	3·52	+ 1·04	·71	29	17	67·0	19	39·0	22	0	...
,,		Banbury	4·21	+ 1·40	1·04	29	18	72·0	18	37·0	9	0	...
IV.		Bury St. Edmunds (Culford)	4·24	+ 1·46	·73	30	17	70·0	12*a*	36·0	5	0	..
,,		Norwich (Cossey)	3·37	+ ·29	·55	29	18	74·5	17	42·5	30	0	...
V.		Bridport	6·12	...	1·23	23	19	...	..	...	...	...	...
,,		Barnstaple.....	5·19	+ ·91	·80	28	17	74·0	18	36·5	14	0	..
,,		Bodmin	7·04	+ 1·80	1·75	23	21	74·0	18	42·0	9	0	1
VI.		Cirencester	4·43	+ 1·29	·89	10	19	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	5·48	+ 2·01	1·15	2	21	71·0	17	44·5	29	0	0
,,		Tenbury (Orleton)	5·14	+ 1·79	·94	10	19	73·0	18	35·2	9	0	0
VII.		Leicester	5·12	...	·94	2	21	77·2	18	40·8	9	0	0
,,		Boston	6·75	+ 4·14	3·10	29	15	72·0	18	41·0	9	0	...
,,		Grimsby (Killingholme).....	4·21	+ 1·14	·88	10	22	69·0	19	42·5	9	0	...
,,		Hesley Hall [Tickhill].....	6·55	...	1·16	10	20	75·0	17*b*	40·0	9, 13	0	...
VIII.		Manchester (Ardwick).....	5·37	+ 1·60	81·	28	20	74·0	18	45·0	9	0	...
IX.		Wetherby (Ribston Hall) ...	4·71	+ 1·63	·72	11	14	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·72	+ 1·14	·63	24	23	71·0	17	37·0	8	0	...
X.		North Shields	3·09	+ ·77	·66	20	21	68·2	11*c*	40·8	6, 23	0	0
,,		Borrowdale (Seathwaite).....	13·37	+ ·15	3·30	26	21	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	6·80	+ 2·00	1·62	23	20	...	...	...	...	...	...
,,		Haverfordwest	7·16	+ 2·11	2·00	1	19	67·8	15	39·4	5	0	...
,,		Plinlimmon (Cwmsymlog) ...	8·21	...	1·30	26	18	...	...	...	...	...	...
,,		Llandudno.....	3·38	— ·37	·59	20	19	68·6	19	46·0	6	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	4·03	— ·38	1·14	26	16	69·8	18	36·6	12	0	...
,,		Hawick	3·52	+ ·88	·72	20	15	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	4·46	+ ·06	·87	26	18	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	2·54	— 3·22	·57	6	15	...	...	...	...	...	...
,,		Appin (Airds)	3·24	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	2·85	...	·38	6,25	18	...	...	...	...	...	.
XVI.		Loch Leven Sluices	3·20	— ·03	1·00	2	12	...	...	...	...	...	...
,,		Arbroath	1·74	— 1·33	·52	26	14	65·0	16	38·0	12	0	...
XVII.		Braemar	4·64	+ ·70	1·35	2	18	65·7	17	30·3	12	1	8
,,		Aberdeen	3·33	...	·80	2	23	65·0	25	33·0	21	0	0
XVIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	3·27	+ ·37	·98	1	14	70·0	3	36·0	21	0	2
XIX.		Dunrobin	2·86	...	·82	2	15	62·5	8	37·5	23	0	...
,,		Orkney (Sandwick)..... ..	3·67	+ ·18	1·07	4	17	62·0	16	40·4	23	0	1
XX.	IRELAND.	Cork (Blackrock)	6·17	+ 2·02	2·98	1	14	78·0	22	43·0	30	0	0
,,		Dromore Castle	7·21	...	2·18	1	21	65·0	16	42·0	4, 10	0	...
,,		Waterford (Brook Lodge) ...	4·75	...	1·75	1	18	70·0	15	38·5	12	0	...
,,		Killaloe	4·41	...	·81	1	16	74·0	16	44·0	16	0	...
XXI.		Portarlington	3·41	+ ·23	·84	1	16	67·0	14	42·0	10	0	...
,,		Dublin (FitzWilliam Square)	3·64	+ 1·23	1·38	1	14	66·7	24	41·2	12	0	0
XXII.		Ballinasloe	4·29	+ ·33	1·07	1	16	64·0	13	40·0	11	0	...
XXIII.		Waringstown	4·10	+ ·75	1·12	28	16	74·0	18	38·0	12	0	1
,,		Londonderry (Creggan Res.).	5·04	...	·79	20	21	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·44	+ ·40	·68	20	19	70·0	17	39·0	30	0	...

+ Shows that the fall was above the average; — that it was below it.

a And 14, 18, 9. *b* And 18. *c* And 27.

METEOROLOGICAL NOTES ON SEPTEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The harvest was gathered in in excellent condition, and the potato crop is said to be the best on record, the yield being extraordinarily good.

BANBURY.—The month was not altogether unfavourable for harvest work, as the R was generally followed by drying wind, and most of the corn has been saved. Mean temp. 55°·0. A TS occurred on 20th, during which an instance of ball lightning was observed by Mr. C. Fortescue and his little boy; it moved slowly among the clouds, going horizontally, and then shooting upwards; it did not appear to strike the earth. The storm was very severe a few miles S. of this station, but not so here; high wind on six days; several fogs.

CULFORD.—The month commenced with cold winds and R, followed by bright and sunny days, favourable for the ingathering of the potato and apple crops; very high wind on 3rd.

CIRENCESTER.—Not a good month for the harvest, and consequently a little corn was injured in backward districts.

WOOLSTASTON.—A warm and pleasant month. Harvest secured in fairly good condition, notwithstanding a considerable amount of R; much damage was, however, done to standing crops by the tremendous gale which commenced on the evening of the 1st, and continued during the night and following morning; severe gales occurred also on the nights of the 23rd and 25th; mean temp. of the month, 55°·4.

ORLETON.—The first ten days were cold and stormy, with heavy falls of R; an interval then occurred of nine days, with much sunshine and temp. above the average; the remainder of the month was generally cloudy, cold, and stormy, with much R; mean temp. of the month more than 1° below the average of 22 years; L and T on 20th; great gales on 2nd and 26th. Much of the spring-planted wheat out in the fields at the end of the month, and some not cut.

KILLINGHOLME.—Weather very unsettled with much R, but a few fine days with brisk winds allowed a good deal of corn to be carried in fair condition.

MANCHESTER.—As a whole the month was wet, especially in the earlier and latter portions; the weather cleared up for several days towards the middle, which was an especial boon to farmers, but the heavy rainfall has been injurious to the cereal crops, though favourable for the green crops.

WALES.

HAVERFORDWEST.—On the last day of August the sky presented a very threatening appearance, large masses of cumuli congregated in the N.W., forming a grand curtain of storm cloud of gorgeous colours at sunset, violent motion being observable in the mass; an opposite current of cloud was advancing rapidly from the S.S.E., and R fell to the amount of ·10 in. in about half an hour before 9 p.m. The morning of the 1st broke stormily, with heavy rainfall, increasing to a heavy gale; the bar. fell from 29·396 in. (corr. and red.) at 9 a.m. to 28·655 in. at 9 p.m., and to 28·410 in. at 3 a.m. on the 2nd, the whole of that day being exceedingly wild and stormy. Although there were a large number of fine days, the rainfall of the month was excessive, but the mean temp. was high, and excellent crops were well harvested.

LLANDUDNO.—Mean temp. slightly below the average; humidity and number of rainy days considerably above the average, but there was a fine spell of dry bright weather from the 11th to 18th inclusive. On 20th it rained persistently, and more or less R fell almost daily till the end of the month. The temp. was very steady throughout; and the range, both diurnal and monthly,

was moderate, and considerably below the average. There was a short but very violent gale on 26th from S.W.; gales from N. and N.E. occurred also on 29th and 30th. There were 121 hours of bright sunshine.

SCOTLAND.

CARGEN.—Mean temp. 54°·2, being 0°·7 below the average; very stormy and wet weather during the latter half of the month; little grain got in, and cut crops much damaged; T and L on 3rd and 18th. T on 1st.

HAWICK.—The middle of the month was mild and favourable for harvest work, but the last nine days were cold and wet; very stormy on the 25th, causing a high flood on the Teviot. Potato disease showed itself towards the close of the month, and the heavy rains of the last days caused it to spread. No frosts occurred, and all tender annuals of the flower garden were blooming beautifully at the end of the month; hurricane on 25th.

ABERDEEN.—Although the general character of the weather was rainy and unsettled, the total rainfall does not exceed the average; L on 1st; brilliant aurora on 5th.

CULLODEN.—The month generally was cold, and, R falling on many days, caused a long-continued ingathering of the crops.

SANDWICK.—A cold month, owing to the prevalence of N. winds, particularly on the first five and last five days; the first week was also very wet, 1·07 in. falling on 4th; the harvest being late, it was well that no equinoctial gale occurred to injure the crop.

IRELAND.

BLACKROCK.—Temp. below the average, but many dry days occurred, favourable for harvest; very heavy R on 1st, after 14 days of dry weather.

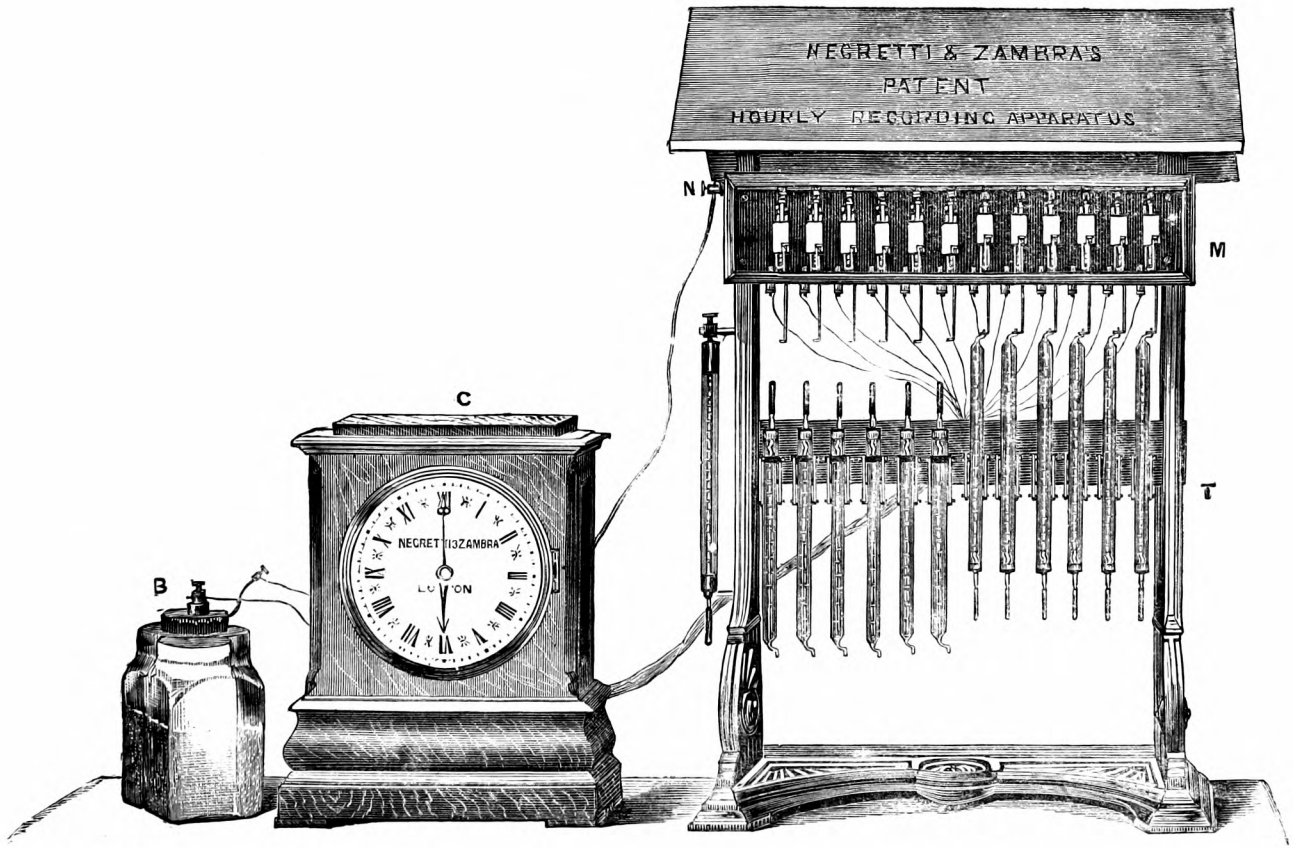
DROMORE CASTLE.—A very disastrous month for the crops; the violent gale of the 23rd levelled corn stooks and haycocks, and a succeeding week of R did not allow them to be made up dry. Temp. high all the month; potato crop in most places still very good.

WATERFORD.—Gales from S.E. on 1st with heavy R, and on 25th from W.S.W. Rainfall about half an inch above the average.

KILLALOE.—A very violent storm prevailed for about two hours on the morning of the 26th: trees were uprooted in great numbers, and corn and hay in stack and shocks were blown down, and scattered about; heavy R succeeded, which seriously injured the unhoused crops. The month closed with strong and steady N. winds, of great benefit to farmers who had suffered from the storm and R.

DUBLIN, FITZWILLIAM SQUARE.—Although rough and unsettled at the beginning and close, this was in general a favourable month—a period of quiet, fine weather lasting from the 9th to 19th inclusive. Mean temp. (54°·7) slightly below the average; of the total rainfall more than one-third fell on the 1st. Very violent storms occurred on the 1st and 26th, and the wind blew strongly on many days both at the commencement and towards the end of the month; solar halo on 18th; aurora on 5th; fog on the 13th to 16th and on 20th.

EDENFEL.—The first and last weeks of the month were stormy and wet, the remaining fortnight being the finest weather of the year; harvest abundant, but not more than half cut, and none carried, at the close of the month; on 15th, ·58 in. of R fell in less than an hour.



NEGRETTI & ZAMBRA'S PATENT HOURLY RECORDING THERMOMETRICAL APPARATUS.—*See page* 150.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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THE ROYAL METEOROLOGICAL SOCIETY.

WE have learned with much satisfaction that Her Majesty has been graciously pleased to grant to the Meteorological Society permission to prefix the title of "Royal," and to become henceforth the Royal Meteorological Society.

There are few societies which can show a better *raison d'être*, few of which, the output of work, (judged both by quality and quantity,) bears a higher ratio to the input of funds. Seventeen years ago the Society applied to the Crown for incorporation by Royal Charter, and that rarely-accorded honour and privilege was granted, and the Society is now further to be congratulated on obtaining Royal patronage, the only remaining distinction which any Society could obtain.

Of course these honours bring no money to the Society; its income depends almost wholly upon the subscriptions of the Fellows, and, if it is fair to judge of its future by its past, there can, we think, be no doubt, that it would be to the advantage of meteorology, of the Society, and also of many of our readers if they became candidates for election as Fellows of the Royal Meteorological Society.

THE BRITISH ASSOCIATION AT SOUTHPORT.

(Continued from page 136*).*

UNDERGROUND TEMPERATURE.

Sixteenth Report of the Committee appointed for the purpose of investigating the Rate of Increase of Underground Temperature downwards, in various Localities of Dry Land and under Water. Drawn up by PROFESSOR EVERETT (*Secretary*).

Observations have been made in the artesian well at Southampton Common by Mr. T. W. Shore, of the Hartley Institution, assited by Mr. J. Blount Thomas.

The well was sunk many years ago to a depth of 1,317 feet, and has remained closed for thirty-two years. It has now been re-opened, and is being carried deeper in the hope of obtaining a supply of water which will rise to the surface.

The brick portion of the well is 563 feet deep, with a diameter of 13 feet at the top and 7 feet at the bottom. A boring with a 7½ inch auger was made 754 feet deeper, giving a total depth of 1,317 feet. The water stands at 40 feet below the surface of the ground, and a tube about 7½ inches in diameter extends from the bottom of the brick well to a few inches above the surface of the water. The thermometer (an inverted Negretti maximum) was lowered through this tube into the boring, and, to aid in carrying it past obstructions, it was enclosed in a perforated cylindrical case of zinc, to which was attached an elongated cylindrical weight, pointed at the lower end to enable it to penetrate mud. The result showed that these precautions were necessary, the zinc case and the lower part of the weight being deeply scratched. The obstructions were chiefly met with at a depth of from 600 to 800 feet, in passing through the Upper Chalk.

The thermometer was lowered very gradually, its descent occupying nearly 15 minutes, and it met with chalk mud at a depth of 1,210 ft. from the surface of the ground. Here it was allowed to remain for 30 minutes. It was then hauled up as slowly as it had gone down, and its indication was 69°·7 F.

Observations were next taken in the same manner at two smaller depths, the temperatures recorded being 57° F. at 400 ft. and 65°·1 F. at 800 ft

These observations were made on January 18. After correspondence with the Secretary, the thermometer was again lowered to the full depth, and allowed to remain there for a week. It was hauled up on February 1, and read 69°·7—exactly the same as in the first observation; and as these observations were taken before the water had been disturbed by any preparations for continuing the boring, 69°·7 may be accepted as truly representing the temperature at 1,210 ft.

The mean annual temperature of the air at Southampton, as calculated by Mr. Shore from the daily observations at the Ordnance Survey Office, for the ten years, 1872–1881, is 50°·0 F. If we allow, in accordance with general experience, an excess of 1° in surface temperature of the soil, we have an increase of 18°·7 for 1,210 ft., which is at the rate of 1° F. in 65 ft.

The Council of the Mining Institute of Cornwall have, at the suggestion of Dr. R. S. Hudson, of Redruth, undertaken a series of observations on underground temperature in Dolcoath mine. The thermometers (of the usual slow-action pattern) were supplied by our Secretary at the expense of the Mining Institute, and the observations were taken by Captain Josiah Thomas, the manager of the mine. It is the deepest mine in Cornwall, and observations have been taken at six points at depths ranging from 252 to 2,124 ft.

The deepest of these six observations was taken under very satisfactory conditions, being in clean granite, about 90 ft. distant from any draught, and in newly-opened ground, only 24 ft. from the end of the working. The temperature observed here—the thermometer having been left for some days in a hole bored for it—was 83° F., and the mean temperature of the air in the district for the past thirty-five years is given by Dr. Hudson as 51°·4. Assuming 52°·5 as the mean temperature of the surface of the ground, we have an increase of 30°·5 in 2,124 ft., which is at the rate of 1° F. in 70 ft.

There is no pyrites in the deep workings, and no heating by chemical action has been noticed. The lode in the deepest part is chiefly composed of chlorite, quartz, and tin ores. All the holes in which observations were taken were dry. Water issues from the rock to the south of the lode at the bottom of the engine

shaft (120 ft. below the deepest of the six observations) at a temperature of about 90°.

A second set of observations under the sea has been obtained by Professor Lebour; this time from North Seaton Colliery, a few miles distant from Newcastle. A slow-action thermometer was employed, in the usual manner, and six readings were taken, all showing the same temperature, 61°. The point of observation was half a mile beyond low-water mark, and 660 ft. below mean sea-level (Ordnance datum), and about 620 ft. below the sea-bottom. Assuming the mean temperature of the sea-bottom to be 48°, we have an increase of 13° in 620 ft., which is at the rate of 1° in 48 ft.

Mr. E. Garside has taken another observation in Ashton Moss Colliery, 90 ft. deeper than before. He finds a temperature of 84° at the depth of 2,880 ft., whereas he previously found 85°·3 at the depth of 2,790 ft. The thermometer used was the same, but it was left forty-eight hours in the hole, besides three hours allowed before insertion; whereas in the previous observation (1881 Report) it was only left six hours in the hole, with ten or fifteen minutes before insertion. Assuming, as before, a surface temp. of 49°, we have an increase of 35° in 2,880 ft., which is at the rate of 1° in 82 ft.

The Secretary has been consulted by the Trustees of the Lick Observatory, about to be erected on a mountain in California, as to the advisability of taking observations of underground temperature there, and the best method to be followed. He has recommended observations at various points for comparing the temperature at 3 ft. deep with the temperature of the air.

One inverted Negretti-maximum and two slow-action thermometers have been entrusted to Mr. T. W. Edgeworth David, Assistant Field Geologist to the Mining Department in New South Wales; and two slow-action thermometers have been supplied to the Engineering Department of the South-Eastern Railway, for observations in the Channel Tunnel.

Since the publication of the "Summary," which accompanied last year's Report, the Secretary has received from Dr. Stapff a communication which renders an important modification necessary in the results for the St. Gothard and Mount Cenis Tunnels. Prof. Everett accepts Dr. Stapff's deductions, and points out that if we assume 1° in 57·8 ft. as the rate for the St. Gothard Tunnel, and also for the Mount Cenis Tunnel, instead of the rates assumed in the "Summary," the effect upon the general mean for all places will be to make it 1° F. in 60 ft., instead of 1° F. in 64 ft.

AURORA.

On some points in Prof. Lemström's experiments in Lapland.

By Mr. J. Rand Capron.

The author pointed out circumstances which led him to consider Prof. Lemström's experiments in Lapland, inconclusive as to the nature of that phenomenon; and in view of the existing sun-spot epoch, advocated experiments in this country, in the same direction.

For this purpose the apparatus mentioned as necessary would be:—

1st. A "collecting" apparatus generally similar to that employed by Prof. Lemström, but modified to suit local circumstances; in

which the mainly important point is the use of insulators upon the Mascart system,

2nd. A spectroscope of large aperture and small dispersion, but provided with some means of accurately measuring the line positions. The disadvantages of most forms of micrometer were pointed out, and it was urged that for line-measurements in so faint a spectrum all extraneous light should be avoided. A form of micrometer was then suggested, by which the auroral light alone was used. It consisted of a slit plate, of which the upper half, and consequently the upper of two superposed spectra, was made to traverse by a suitable micrometer screw the lower, and the bright "citron" line of the aurora was employed to measure the position of the fainter lines. (This slit plate was exhibited and described.)

3rd. A galvanometer for the measurement of the intensity and direction of earth currents.

4th. An electrometer of the Thomson "Quadrant," or "Portable" pattern for the examination of the character and degree of atmospheric electricity at and about the time of auroral displays.

5th. Some simple form of theodolite or alt-azimuth instrument for the measurement of magnetic positions, altitudes, inclinations, &c., of auroral arches and beams.

Lastly. Mr. Capron pointed out that Prof. Lemström's collected (not "artificial") aurora, had not been compared with other gaseous or chemical spectra, that hitherto no spectrum of an artificial electrical discharge had been found comparable with the aurora spectrum, and that now, if an aurora could be, so to speak, held captive, would be the opportunity for the chemists to come in aid of the spectroscopists, for the solution of the auroral mystery.

In reference to this subject, Mr. Capron informed us that he has prepared a set of apparatus for observations, in case of coming auroræ.

The galvonometer is of the double needle form, with special arrangements for regulating the amount of tension, and wound to a resistance of 1,004 ohms. The electrometer is a modification of Sir William Thomson's quadrant with similar arrangements for regulating deflection. The theodolite is at present a wood and card-board model, with arrangements for taking positions from the magnetic pole, altitudes from a given horizon, inclination and angles of beams, &c. Polariscopic eye-pieces are added, to enable observations on this disputed question to be made. It is proposed to erect a collecting apparatus on a tower, which is a prominent feature on the Hog's-back chalk ridge, near Guildford, and is the nearest suitable elevation to the Guildown Observatory.

MARINE ANEMOMETER.

By W. G. Black, F.M.S.

The principle of the marine anemometer exhibited was suggested by the sail of a ship, the pressure of wind upon a small one being registered on a scale.

A short hollow tube or mast carries a sail one foot square attached to a fixed yard above, and to another yard below, which is free. From this proceeds a sheet or cord, which descends to pass under a pulley let into the lower end of the mast, and then ascends inside it to be attached to a moveable plug carrying an index. In the upper half of the mast lies a spring-wire-coil, fixed above, but free below to be attached to the plug carrying the index.

The stronger the wind the greater the belly of the sail, and therefore the more do the yards approach each other, and therefore the greater the tension of the spring and the greater the pressure indicated, as the sheet or cord will always be kept taut by the spring, so will the body of the sail be always tightly stretched and full of wind.

The scale on the outside of the mast is divided into inches and pounds to indicate by the movement of the pointer the pressure on the sail, and its extent of abduction. The mast carries a loose vane on the top, and is planted into a solid plinth below, which has an index on its outside rim.

This again revolves horizontally on a fixed plinth below, attached by a screw, bolt, and nut to the railing of the ship, and bears on its outside rim a scale of degrees. This scale will indicate the direction of the wind pointed to by the vane, in relation to the course of the vessel, and also the bearing of the sail to the ship and vane. When in use, the sail will require to be turned by hand towards the direction of the apparent wind, and the pressure and direction can then be read off on the scales.

In order to find out the true direction and force of the wind it will be requisite to construct a diagram of the triangle of forces in terms of velocity of wind per mile. One side would be put down to represent the speed of the ship in miles per hour, another side the velocity of the wind indicated by the scale; the angle would be read off from the plinth, and the third side would be drawn joining the extremities of the other two.

The length of this side would indicate the velocity of the true wind in miles per hour, and its direction the true angular course of the wind outside the ship. A model has beeen stationed on a ship going to Brazil, and its performance in the open sea will in due time be reported.

ON MEASURING THE HEIGHT OF CLOUDS.

By Prof. Luröth, of Freiburg, Baden.

Of this communication we have not yet received a full abstract, and therefore we may have occasion to refer to it subsequently, but we believe that the idea was to project a beam of powerful electric light vertically towards the zenith, and that simultaneous trigonometrical measurements should be taken of the luminous spot which would be thereby formed.

A very brief discussion followed, in which Mr. Symons stated that

he believed something slightly approaching this method had occasionally been tried at the Royal Observatory, Greenwich, by noting the altitude at which the lights of London were reflected by the clouds hanging over it.

NEGRETTI & ZAMBRA'S TURNOVER THERMOMETERS.

WE ought, perhaps, to apologise to Messrs. Negretti for not adhering to the title which they have given to the apparatus we are about to notice; but there are two reasons for not doing so. In the first place, most of our readers know the merits of Negretti's turnover thermometers, and will almost immediately completely understand the new arrangement; and, secondly, we object to the title, "Negretti and Zambra's Patent Hourly Recording Thermometrical Apparatus," on several grounds. It is too long for the present quick-thinking generation; it does not individualize their arrangement from the many patterns of recording thermographs, and, lastly, we think that to be entitled to the designation of hourly, there should be 24 thermometers rather than 12.

All these matters are, however, non-essential. We have to criticise the apparatus as it stands, and to see how far we should or should not be justified in recommending its general use.

As regards the action of these turnover thermometers we have nothing to say except praise. We have had a double turnover, *i.e.*, a dry bulb and a wet bulb, at work for many years, and we cannot recollect it failing to act on a single occasion, although it and its clock have been exposed in all weathers to wet, snow, fog, and all the evils of a London atmosphere. Hence it was that we advised Mr. Wragge to establish one on the top of Ben Nevis, and there also we believe that it acted perfectly.

In the present apparatus the novelties are twofold. First, that there are a dozen thermometers, so that by reading twice daily, the absolute temperature at each hour could be obtained; or by reading once daily, and slightly altering the clock, the temperature by a single reading could be obtained at each two hours. Secondly, the thermometers are turned over by an electric current, instead of by the direct action of the clock. This latter novelty enables the clock to be kept at a distance from the thermometer, and, therefore, to be protected from the weather. Our personal experience of out-of-door clocks (and we have three at work—one upon a Glaisher thermometer stand, one in a Stevenson stand, and one in a Casella's recording rain gauge) is, that they suffer very little from exposure, and as we never use electrical arrangements where mechanical ones will suffice, we should for most stations prefer that the thermometers were released mechanically, which would, we think, be both more certain and less costly than the electrical arrangement.

We do not overlook the fact, that the electrical arrangement allows the thermometers to be exposed "at any distance from the

clock and battery," but we do not see what is gained thereby. The observer must visit the thermometers in order to read them, and therefore they cannot be placed in a difficultly accessible position, and where the thermometers are, there the clock may very well be.

Before summing up the merits and demerits of the apparatus, it may be well, for the benefit of those not used to this pattern of thermometer, to state its principle very briefly. It is essentially that of Negretti's maximum thermometer, viz., a rather large-bulb-thermometer filled with mercury, and with its tube obstructed at a point near the bulb. While the bulb is at the bottom, the mercury rises and falls past the obstruction, when the thermometer is suddenly turned bulb uppermost, the column of mercury breaks off at the obstruction, falls to the other end of the tube and remains there, the length of this detached portion shows the precise temperature at the instant of its being turned over.

Let us now consider—

Merits.	Demerits.
It is perfectly accurate, and not liable to derangement.	It does not give a continuous record, and therefore would not give details of the passage of squalls of hot or cold air; in short, it is not well adapted for what may be called charto graphic meteorology.
It is very easily manipulated.	
There are none of the many worries of photographic registration.	
It is far less liable to injury in carriage than most thermographs.	
An apparatus with 12 thermometers read once daily, *i.e.*, a set of two hourly readings, would, in the course of very few years, give the diurnal range-curve as accurately as is at all necessary.	

REVIEWS.

Handbuch der Klimatologie. Von Dr. J. Hann. 8vo. x.—764 pages. Stuttgart: Engelhorn, 1883.

Dr. Hann's reputation for ability and industry stands so high that merely to mention the title of this work, and its author, is sufficient to recommend its purchase by all meteorologists who are conversant with German, and the very solid volume now before us would amply justify the anticipation.

A brief introduction, pointing out the true domain of climatology and wherein it differs from meteorology and from mere weather records is followed by a carefully-worded and fully-illustrated consideration of the various meteorological elements which, combined, afford the numerical exponents of the climate of every place. This section occupies 54 pages.

The next section deals with climates in general, being divided into solar and terrestrial climates, with sub-division for solar radiation,

land and sea climates, and the influence of altitude upon climate. These subjects occupy 174 pages.

The great bulk of the volume (536 out of 774 pages) is devoted to "special climatology," divided primarily into tropical, temperate and polar zones, and sub-divided into about thirty sections. The work already done by Dr. Hann in preparing for insertion in the *Zeitschrift*, the many notes upon local climate which have appeared therein, have stood him in good stead in the present work, and the result is one which is as creditable to the author as it is useful to all intrested in the subject.

Probably the best idea of the work will be conveyed by translating the paragraphs relating to one district, as a type of those given for others—it is quite immaterial which, and as we open the book upon page 374 we take it—it is a portion of the section devoted to tropical America :—

"*Climate of the Andes and of the West Coast.* The places whence regular observations have been obtained are shown in the table. [Too long to quote here.] From which it will be seen that at Bogota, 8,727 ft. above the sea, the warmest month has about the same temperature as the middle of May in Vienna, and the coldest month that of the first days of May, whence the uniformity of the temperature is evident. The entire range lies between 43°·5 and 74°·3.

"Humboldt describes the climate of Bogota as a perpetual spring, but the popular saying is nearer the truth in asserting that the year consists of ten months rain, and two months heavy rain. The perpetual spring is in fact a perpetual April, and moreover without any stoves or arrangements for warming the houses. If between two showers the sun shines forth with full force, the houses with their ever-damp walls of unburnt bricks appear doubly damp and icy. In the summer months there are visitations of a peculiar cold wet mountain mist known as "Paramitos" which without warning wraps the town in a gray cloak, and vanishes with equal suddenness. (M. v. Thielmann).

"Similar but still colder and more like our German April weather is the climate of Quito.

"Whymper is also no admirer of the renowned equability of the climate of the high plateaus of the Andes. He says—"I do not myself profess entire admiration for it, for the incomparable—some persons say, the abominable laziness of the Ecuadorians has an intimate connection with the much admired equability of climate, which renders it almost certain that to-morrow will be like to-day. They therefore put off doing everything until to-morrow, and when to-morrow arrives until the next day, and so on." The temperatures which Whymper observed on the Andes near Quito were—on Chimborazo (20,516 ft.), on January 4th, 21°; on July 3rd, from 15° to 20°; Cotopaxi (19,550 ft.) having spent the night on the summit, February 18th, 13° to 21°; Cayambe, 19,190 ft., April 4th, 32° to 41°. At Antisana (19,260 ft.) the temperature was remarkably high and variable on March 10th, within two hours in the shade and with a calm air the temperature varied from 44° to 60°.

The highest temperature which Whymper observed in Ecuador was 75°·6 in the plain of Quallabamba [N. of Quito]."

In order to complete the illustration we extract from the tables some of the numerical data.

STATIONS.	Latit ude.	Altitude.	TEMPERATURE.					RAIN
			Yearly Mean.	Coldest month.	Warmest month.	Absolute. Min.	Max.	
		Feet.	°	°	°	°	°	In.
Bogota (3 yrs.).	4°35′ N.	8,727	57·9	Aug. 56·1	Mr. No. 59·2	43·5	74·5	73·94
Quito (1½ yrs)..	0°14′ S.	9,350	55·6	July 54·5	No. Ja. 56·5	37·9	74·8	46·66
Antisana (1 yr.)	0°21′ S.	13,320	40·8	Jy.,Au. 37·4	Jan. 43·2	20·8	51·8	...

If our readers will in imagination multiply the above information by 500 and add thereto short notes on all branches of climatology, from that of the influence of Arctic cold upon the human frame to the laws of the cyclones in the Bay of Bengal, and from the relative humidity of climatic health-resorts to the influence of the earth's rotation upon the direction of the great currents of the atmosphere, they will begin to realize the treasury of information which Dr. Hann has given to the world.

There is, as far as we can see, only one respect in which the book could be improved, namely, by giving references to the books quoted. Dr. Hann is most conscientious in giving credit to the authors of most of the statements which he quotes, but we should have preferred references in full, as for example in Schmidt's *Lehrbuch*. We may illustrate this by the very quotation which we have made. Humboldt is said to have called the climate of Bogota perpetual spring, words which convey ideas very different from those suggested by M. v. Thielmann. Persons interested in the Bogota climate would naturally like to consult M. v. Theilmann's work and judge whether he or Humboldt is to be believed.

The book is so good that a second edition cannot be a remote possibility, and when it appears, this additional information would, we think, be useful.

Wiesen as a Health Resort in Early Phthisis. By A. T. TUCKER WISE, M.D., F.R.Met. Soc., &c. Post 8vo, 77 pages, several folding tables and map. London : Baillière, 1883.

THE *Lancet* says that "There can be no doubt that Davos is an invaluable resort for many young and active people with incipient phthisis," and therefore we have nothing to do but to bow reverentially before the *Lancet*, Dr. Tucker Wise, Dr. Weber, Dr. Theodore Williams, Dr. Burney Yeo and others. No doubt it is quite true and quite right, but to a non-medical mind it seems rather droll, that whereas in past times all possible care was taken to select mild

climates like Ventnor, Penzance, and the string of health resorts along the northern shore of the Mediterranean, we are now told that the correct thing is to go up into the most cold and snowy valley that can be found. And we are not helped out of our puzzle by the author of the work before us saying on page 5, that one of the advantages of Andermatt is, that being "on the St. Gothard line, visitors can move on to the Riviera in a few hours if the mountain air is found unsuitable."* That would be a change of climate with a vengeance, and seems to contradict the explanation of the choice of antithetical localities which we had intended to submit, viz., that different varieties, and stages, of disease required one or the other extreme.

Fortunately it is not our duty to consider the proper climate for invalids, but to report upon Dr. Tucker Wise's book as a contribution to climatology.

Somebody—probably not the author—has made a muddle of determining the altitude of Wiesen. It is to be hoped that they refer to different parts of the village; if so, the author should have said so; if they do not, the following differences are not creditable to the parties concerned:—

Altitude of Wiesen above Sea Level	{	5050 ft....Swiss Metorological Society. 4990 ft....Dr. Frankland, F.R.S. 4771 ft....Dufour's Trigonometrical Survey.

Concerning the section headed "Meteorological Notes" we have but few remarks to offer. The comparability of the temperature records was risked—we do not say injured—by the erection of a canvas screen to protect the Stevenson's stand from the intensity of the sun's rays. In all probability its effect was inappreciable, but if it had been, it would have been so much the worse, for then the results would not have been comparable with those of other stations.

Dr. Tucker Wise, deserves the thanks of meteorologists for the evidently extremely careful way in which he kept his meteorological records during last winter. But he adds one more to the many instances which prove the necessity of actual training and teaching before commencing the keeping of a register. Let us not for a moment be misinterpreted—we really accept the figures given as valuable, as accurate, and as absolutely true—but Dr. Wise need not, and should not, have read his max. and min. thermometers two, three, or even four times a day; nor should he enter as the mean of a month, the mean of 20 out of 28 days.

The purchase of a perfect set of instruments, the trouble involved in their transport across two-thirds of Europe, their erection in a snow-clad village, their observation with great regularity generally four times daily, and finally the printing *in extenso* of the observations,

* The author, however, plunges us into another difficulty a few pages further on, p. 18:—"On the other hand, the advisability of making a rapid descent from a high altitude to the low-lands, even for convalescents, is questionable." Just so; but if so, what becomes of the advantage of Andermatt.

form collectively abundant evidence of devotion and zeal. The faults which we have mentioned are capable of easy reparation, and they only prove what we have often urged, the necessity of instruction in meteorology being made a part of all first-class educational systems.

In conclusion, we desire to add one word of very hearty praise, viz., for the most unusual impartiality of the author. As a too general rule, writers upon the climate of any locality see it always through rose-coloured glasses. Dr. Tucker Wise seems to us tobe impartiality personified.

AN EXTRAORDINARY METEOR.

WE quote the following wonderful story from *Nature* of November 1st. Our contemporary gives it on its own authority, and we reprint *verb. et liter.* :—

"On Monday, September 24th, about 9 p.m., a remarkable phenomenon occurred at Käringön, in the province of Bohus, Sweden. During a perfect calm a whirlwind suddenly arose from the south-east, carrying with it a quantity of sand, earth, and straw, when suddenly a bright light lit up every object and made the night as clear as day. This was caused by a magnificent meteor, egg-shaped in form, which appeared in the zenith, and which at first seemed to consist of myriads of large sparks, gradually changing into a star shining with a blinding lustre, and which burst, with all the colours of the rainbow, in the north-west, four or five metres above the horizon. When the meteor had disappeared, the wind suddenly fell, and it was again perfectly calm. The phenomenon lasted about sixty seconds. The wind had throughout the day been south and very slight.

RAINFALL IN CENTRAL AFRICA.

IN the *Annuaire* of the *Soc. Met. de France* for May of the present year, M. A. Angot gave an interesting summary of Meteorological observations made near Tanganyika; he has recently favoured us with the continuation of them down to the end of 1882. From these two sources we have compiled the table on the following page.

Doubtless in such a mountainous district as that in which these observations have been made, and scattered as the stations are over an area larger than England and Wales, considerable differences in amount will exist. There is no information as to how the rain gauges were placed, and we have no information as to the seasons being average, or very wet,or very dry. But in spite of all these uncertainties, we have thought it worth while to try and ascertain the yearly mean fall which they indicate, and also its seasonal distribution. The values are so uncertain that it is not worth while to explain the steps by which they have been obtained, and they are offered only in the absence of anything better.

Urundi, average yearly total, 52 in.
Massanzés ,, 56 in.
Victoria Nyanza ,, 63 in.

Monthly distribution in inches, average for the three stations :—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
7	6	6	11	6	1	1	2	2	2	4	8	56

Month.	Tanganyika.						Victoria Nyanza.		
	Urundi.			Massanzés.					
	Total	Days over ·02	Days under ·02	Total	Days over ·02	Days under ·02	Total	Days over ·02	Days under ·02
	in.			in.			in.		
1880									
December.. ...	5·43	20	5	...	...	...	...	...	...
1881									
January	7·05	17	12	...	...	...	..	...	..
February	5·47	14	3	...	...	...	...	...	...
March	4·88	13	1	...	...	...	...	...	...
April.....	9·13	21		...	...	...	12·40	20	
May	*2·32	5		...	...	...	4·33	14	3
June	...	...	...	...	...	...	2·17	14	
July	...	...	...	+ ·83	2		3·07	9	
August.....	...	...	...	‡ ·24	2		5·59	13	1
September ...	...	...	...	·35	1	...	3·47	10	1
October.....	..	...	...	§ ·24	1	...	‖ ·16	3	1
November ...	...	...	...	...	...	...	...	...	...
December.....	...	...	...	...	...	...	...	...	...
1882									
January	...	...	...	...	...	...	...	...	...
February	...	...	...	...	...	...	...	...	
March	...	...	...	¶4·02	5	4	...	...	...
April.....	...	...	...	10·43	20	4	...	...	..
May	...	...	...	7·87	15	2	...	...	...
June	...	...	...	·00	0	0	...	...	...
July	...	...	...	·00	0	0	...	...	...
August.....	...	...	...	·51	1	0	...	...	...
September ...	...	...	...	1·22	3	1	...	...	..
October.....	...	...	...	2·95	7	4	...	...	...
November ...	...	...	...	4·57	12	5	..	...	...
December.....	...	...	...	9·73	18	2	...	...	...
Max. daily fall	2·56in. Jan. 12, 1881			3·74in., April 26, 1882			2·28in., April 24, 1881		
Lat.	? 4° S.			? 4° S.			0° 19′ N.		
Lon.	? 30° E.			28° E.			33° 0′ E.		
Altitude							5580 ft. ?		

* To 9th only. + From 13th. ‡ To 17th only. ¶ From 12th. § To 17th only. ‖ To 4th only.

TONQUIN.

We are glad to be able to announce the safe arrival, at Hanoi, of Dr. Borius. All his instruments, both self-recording and others, had travelled without injury, and were in operation at the date of last advices. Dr. Borius has found that a record of well-placed instruments has been kept at Hue, and he is preparing a summary of the results.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·16	XI.	Llanfrechfa Grange	3·82
,,	Margate, Birchington...	2·04	,,	Llandovery	5·39
,,	Littlehampton	2·72	,,	Solva	2·61
,,	St. Leonards	3·31	,,	Castle Malgwyn	5·16
,,	Hailsham	2·72	,,	Rhayader, Nantgwillt..	6·89
,,	I. of W., St. Lawrence.	2·76	,,	Carno, Tybrith	6·53
,,	Alton, Ashdell.....	2·96	,,	Corwen, Rhug	5·30
III.	Winslow, Addington ...	1·92	,,	Port Madoc	6·06
,,	Oxford, Magdalen Col...	1·90	,,	I. of Man, Douglas	4·58
,,	Northampton	1·62	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	1·41	,,	Melrose, Abbey Gate ...	3·72
IV.	Southend	1·59	XIII.	N. Esk Res. [Penicuick]	3·90
,,	Harlow, Sheering	1·91	XIV.	Ayr, Cassillis House ..	5·86
,,	Diss	2·95	,,	Glasgow, Queen's Park.	3·28
,,	Swaffham	4·26	XV.	Islay, Gruinart School..	4·67
,,	Hindringham	3·59	XVI.	St. Andrews, Newton Bk	2·22
V.	Salisbury, Alderbury...	2·66	,,	Aberfeldy H.R.S.	3·69
,,	Warminster	2·86	,,	Dalnaspidal H.R.S. ...	8·89
,,	Calne, Compton Bassett	2·30	XVII.	Keith H.R.S.	1·64
,,	Beaminster Vicarage ...	3·86	XVIII.	Forres H.R.S.	1·03
,,	Ashburton, Holne Vic..	7·20	,,	Strome Ferry H.R.S....	6·81
,,	Torrington, Langtree W.	...	,,	Lochbroom	7·39
,,	Lynmouth, Glenthorne.	5·20	,,	Tain, Springfield.....	2·32
,,	Probus, Lamellyn	4·17	,,	Loch Shiel, Glenaladale	13·38
,,	Taunton, Fullands	2·62	XIX.	Lairg H.R.S.	4·57
VI.	Bristol, Clifton	3·42	,,	Forsinard H.R.S.	4·68
,,	Ross	...	,,	Watten H.R.S.	2·78
,,	Wem, Sansaw Hall.....	2·77	XX.	Fermoy, Glenville	3·58
,,	Cheadle, The Heath Ho.	3·67	,,	Tralee, Castlemorris ...	4·28
,,	Worcester, Diglis Lock	2·44	,,	Tipperary, Henry Street	3·45
,,	Coventry, Coundon	3·00	,,	Newcastle West	3·95
VII.	Melton, Coston	2·16	,,	Kilrush	...
,,	Ketton Hall [Stamford]	1·78	,,	Corofin	3·70
,,	Horncastle, Bucknall ...	2·80	XXI.	Carlow, Browne's Hill..	2·04
,,	Mansfield, St. John's St.	2·99	,,	Navan, Balrath	2·77
VIII.	Macclesfield, The Park.	5·16	,,	Athlone, Twyford	3·54
,,	Walton-on-the-Hill... .	5·06	XXII.	Mullingar, Belvedere ...	3·11
,,	Lancaster, South Road.	4·57	,,	Clifden, Kylemore	8·19
,,	Broughton-in-Furness ..	6·60	,,	Crossmolina, Enniscoe..	5·99
IX.	Wakefield, Stanley Vic.	2·98	,,	Carrick-on-Shannon ...	3·40
,,	Ripon, Mickley	3·09	XXIII.	Dowra	...
,,	Scarborough.....	3·47	,,	Rockcorry.....	3·41
,,	East Layton [Darlington]	2·65	,,	Warrenpoint	3·36
,,	Middleton, Mickleton ..	3·57	,,	Newtownards	2·82
X.	Haltwhistle, Unthank..	3·71	,,	Belfast, New Barnsley..	4·13
,,	Shap, Copy Hill	7·00	,,	Bushmills	3·25
			,,	Buncrana	4·75

OCTOBER, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32° In shade.	No. of Nights below 32° On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·75	— ·95	·46	15	14	64·6	15	36·9	22	0	3
II.		Maidstone (Hunton Court)...	2·66	+ ·20	·80	4	13	...	...	...	...	...	...
,,		Strathfield Turgiss	1·77	— ·97	·44	15	16	62·4	10	34·8	22	0	8
III.		Hitchin	1·87	— ·31	·39	14	13	60·0	16	35·0	22	0	...
,,		Banbury	2·25	— ·51	·77	15	14	62·0	8	35·5	7	0	...
IV.		Bury St. Edmunds (Culford)	2·83	+ ·66	·60	3	15	63·0	25	34·0	2, 21	0	..
,,		Norwich (Cossey)	3·59	+ 1·26	·94	3	18	63·0	25	37·0	22	0	0
V.		Bridport	3·21	...	·88	15	17	...	..	...	...	...	...
,,		Barnstaple.....	5·02	— ·43	·72	15	16	65·0	10	41·0	21*a*	0	..
,,		Bodmin	4·48	— 1·79	1·02	13	20	60·0	9	31·0	21	0	1
VI.		Cirencester	2·77	— ·47	·49	14	14	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	3·38	— ·72	1·04	15	23	65·0	8	35·0	22	0	2
,,		Tenbury (Orleton)	2·78	— ·46	·88	15	20	63·2	25	32·0	7	1	4
VII.		Leicester	2·16	...	·43	3	22	64·2	8	37·0	7, 21	0	9
,,		Boston	2·43	+ ·40	·60	14	14	65·0	8	37·0	22	0	...
,,		Grimsby (Killingholme).....	3·75	+ 1·10	·92	14	24	65·0	8	37·0	22	0	...
,,		Hesley Hall [Tickhill].....	3·17	...	·66	3	16	67·0	8	33·0	22	0	...
VIII.		Manchester (Ardwick).....	5·24	+ ·81	·76	16	17	65·0	14	33·0	22	0	...
IX.		Wetherby (Ribston Hall) ...	2·60	— ·76	·75	17	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	8·65	+ 1·39	1·48	16	23	64·0	8	27·0	21	2	...
X.		North Shields	1·58	— ·93	·43	3	17	63·8	9	29·0	22	1	1
,,		Borrowdale (Seathwaite).....	15·62	— ·93	3·02	22	21	61·6	8	28·2	22	...	...
XI.	WALES.	Cardiff (Ely).....	4·55	— ·68	·80	15	16	...	...	...	...	...	...
,,		Haverfordwest	5·08	— 1·37	1·30	14	17	64·0	8	31·5	6	1	3
,,		Plinlimmon (Cwmsymlog) ...	6·80	...	·91	2	21	...	...	...	..	...	...
,,		Llanduduo.....	4·11	— ·48	1·06	16	20	61·0	9, 29	38·5	22	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·78	— 1·93	·69	14	15	65·2	8	25·8	22	2	...
,,		Hawick	3·54	+ ·37	·82	17	17	...	...	.	...	..	...
XIV.		Douglas Castle (Newmains)	6·38	+ 1·44	·89	14	17	..	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	7·52	— ·80	1·12	13	23	...	...	...	...	...	...
,,		Appin (Airds)	6·05	...	...	...	...	...	...	..	...	...	...
,,		Mull (Quinish).....	8·12	...	1·72	13	28	...	...	.	...	...	.
XVI.		Loch Leven Sluices	3·70	— ·61	·90	19	...	...	...	...	...	...	...
,,		Arbroath	1·56	— 1·31	·35	14	12	65·0	7	33 0	22	0	...
XVII.		Braemar	3·57	— ·91	·65	14	20	67·0	7	26·3	12	2	24
,,		Aberdeen	1 97	...	·76	14	14	74·0	8	30·0	11*b*	3	...
XVIII		Skye (Sligachan)	15·34	...	4·62	13	27	...	...	...	...	...	...
,,		Culloden	1·73	— ·56	..	...	...	59·0	14	31·0	10	1	13
XIX.		Dunrobin	4·43	...	1·50	19	17	69·0	8	31·0	12	...	...
,,		Orkney (Sandwick)	4·03	— ·26	·53	24	23	58·8	9	38·6	3	0	4
XX.	IRELAND.	Cork (Blackrock)	3·00	— 1 74	·58	15	17	71·0	8	33·0	19	0	...
,,		Dromore Castle .,.....	5·39	...	·90	15	19	62·0	8	34·0	20*b*	0	...
,,		Waterford (Brook Lodge) ...	2·97	...	·56	15	17	62·0	7	27·5	22	1	...
,,		Killaloe	4·83	...	·58	16	19	70·0	8	32·0	21	1	...
XXI.		Portarlington	2·32	— 1·15	·46	15	17	63·0	8	34·0	21	0	...
,,		Dublin (FitzWilliam Square)	2·20	— 1·22	·44	24	16	63·8	8	34·5	22	0	1
XXII.		Ballinasloe	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	3·25	— ·36	·51	24	17	68·0	8	29·0	21	1	7
,,		Londonderry (Creggan Res.).	4·56	...	·50	22	24	...	...	...	...	...	...
,,		Omagh (Edenfel).....	5·02	+ ·70	·65	24	25	62·0	8,9	30·0	21	1	...

+ Shows that the fall was above the average : − that it was below it.

a And 22. *b* And 21.

METEOROLOGICAL NOTES ON OCTOBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—An unsettled month, colder at the close, with one or two gales and considerable rainfall, but not more than was needed for the newly-seeded land; the seed-time so far has been most favourable, greatly contrasting with last year.

BANBURY.—Mean temp. of the month 49°·4; high wind on 10 days; parhelion seen on 2nd; on 17th a little after 2 p.m. fragments of halos were seen with very delicate prismatic colouring about the sun, upon a ground of fine snowy cirro-cumulus with at one time incomplete smaller circles of a reddish colour.

CULFORD.—Heavy rains and high winds were frequent throughout the month, but there was a good deal of mild, bright weather.

COSSEY.—Notwithstanding the heavy rains which occurred during the latter part of September and the early part of October, the land was in a good state for wheat sowing, and that important operation may be said to have been completed in this county by the end of the month.

BODMIN.—Mean temp. of the month 51°·9 being 1°·0 below the average.

CIRENCESTER.—Rainfall moderate, a seasonable month for agricultural purposes.

WOOLSTSATON.—The latter part of the month was very favourable for the autumn sowing. Mean temp. 48°.6; sharp storm with T and L on 3rd; severe gales accompanied by H from 15th to 17th.

ORLETON.—The sky was generally covered with cloud, and there was very little sunshine during the month; the air was generally damp, and heavy falls of R occurred on the 14th and 15th. The temp. was generally steady, and the mean was slightly below the average; very rough winds occurred on the 4th and 15th; distant L was seen on the night of the 3rd.

LEICESTER.—The month was mild though damp and cheerless, R falling on 22 days.

KILLINGHOLME.—The weather during the greater part of the month was very wet, almost daily R retarding the harvest of the late crops, but the last week was fine and mild, and wheat sowing was carried on under far more favourable conditions than last year.

ARDWICK.—On the whole an unsettled month, with a pretty heavy rainfall; the weather about the middle was very stormy, but towards the end it became more settled, with a few fine days; frost on one or two mornings.

WALES.

HAVERFORDWEST.—From 3rd to 6th, stormy, very rough and cold, with H, T and L on the evening of the 3rd; very close damp weather from the 8th to 10th; after which stormy weather with variable temp. prevailed till the 22nd, with low bar. min. 29·171 in. at 4 a.m. on 16th; very heavy gale on the 15th, from S.W., about 5 p.m. the wind shifted to N.W. when it blew very hard, heavy R falling with squalls of great violence through the night; on the 16th at 2.30 a.m., I was out and experienced a terrific squall of wind accompanied by tremendous H, T and forked and sheet L, the hailstones were very large; near St. Davids, the L struck and fused a great length of telegraph wire, some animals were also killed. The spring tide and flood with the wind from S.W. combined to produce the highest tides that have been recorded during the last 20 years. From the 21st to the end of the month the weather was mild, calm and cloudy; on many days the sun was never visible; no frost; wild strawberries in blossom.

LLANDUDNO.—Mean temp. about the average. The temp. was very equable, the range, both diurnal and monthly, being considerably less than the average; the relative humidity was also below the average, though the

number of rainy days exceeded it. Sharp TS at 4.45 p.m. on 3rd; much L in the evening, and another slighter storm on the 16th; sunshine deficient, only 90 hours.

SCOTLAND.

CARGEN.—Mean temp. 1°·3 below the average, sunshine also below the average. A very sudden rise of temperature occurred on the night of the 24th-25th; the max. temp. of the 24th was 48°·2, and at 9 p.m. it was 46°·2. Shortly after this the temp. commenced to rise quickly and continued to do so till 1 a.m. of the 25th, when it stood at 57°·2. This sudden rise in the temp. was accompanied by a gale from the S.W. with heavy R. At 9 a.m. of the 25th, the ther. stood at 50° and the max. during the day was 51° thus the temp. shortly after midnight exceeded by 6°·2, the highest day temp. of the preceding and following days, and in fact the maximum temperature of the ten previous days. A deep depression travelling very rapidly in an easterly direction passed the N. of Scotland on the night of the 24th-25th.

HAWICK.—The month on the whole was cold and wet; but the last four days were remarkably warm and mild. Loud T on afternoon of 17th; green peas gathered throughout the month.

QUINISH.—A cold, wet, stormy month.

ABERDEEN.—The max. temp. 74° on the 8th is also the max. during the year, and there was a total immunity from E. winds during the whole month, which is quite exceptional here, and has not occurred previously since 1874. Rainfall an inch below the average; auroræ observed on 5th and 20th.

CULLODEN.—The month was dry and fine up to the 14th, and the temp. very equable; heavy gale on 27th, and early morning of 28th.

SANDWICK.—On the first 3 days of the month H and S showers occurred with frost at night, but afterwards the weather was more favourable, and the grain crops were secured in good condition; the potato crop is particularly good both as to quantity and quality. October is generally our wettest month, and it has been wetter than any previous month this year, but drier than the mean of the previous 42 years. T and L on 18th at 8 p.m.; a storm of wind of 70 miles an hour on 25th from 9 to 11 a.m. Bright aurora was seen on 5th, and as it was an observation of the late Sir Robert Christison that the first bright aurora in harvest was followed by fine weather next day, and coarse weather on the following one, I ventured to give warning, and the observation proved to be correct.

IRELAND.

DROMORE CASTLE.—A wet stormy month with high temp.; heavy gale on the night of the 12th, L and T on the 15th. Great difficulty was experienced in gathering the corn and hay, which remained in large quantities in the field at the close of last month.

WATERFORD, BROOK LODGE.—Month generally dull and close; R is below the average, no heavy fall; L on 24th.

KILLALOE.—Constant R from 12th to 25th, with frequent severe squalls from S. and S.W.; mean temp. (50°·4) below the average.

DUBLIN, FITZWILLIAM SQUARE.—Changeable as October generally is, this month proved no exception to the rule. The mean temp. was as nearly as possible equal to the average of 18 years, but it is noteworthy that the first week was decidedly colder than the last week, and that a remarkable increase of temp. occurred on the 7th, lasting for several days. The rainfall was considerably below the average, and the number of rainy days also fell short of the average; L on 3rd and 15th; solar halos on 5th, 12th, 19th and 22nd; lunar halos on 11th and 15th. Fog on 8th, 12th and 29th.

WARINGSTOWN.—A damp month, temp rather above the average, oat crop very late, and fields only completely cleared during the last week of month.

EDENFEL.—With the exception of the second week and a few dull humid days at the end of the month, the weather of October was extremely wet stormy and inclement; much grain was still out in the mountainous districts at the close of the month.

SYMONS'S
MONTHLY
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THE SUNSETS AND THE JAVA EARTHQUAKE.

WE have always endeavoured to avoid printing in these pages matter which has appeared, or will appear, elsewhere, except in so far as it is indispensable, if our readers are to be kept fully aware of all that is going on in the meteorological world; and we specially object to reprinting anything written by ourselves, it is bad in principle and it looks conceited; yet as regards the subject on which much public interest is now felt, we see no better way of bringing it before our readers than by reprinting in small type a letter which appeared in *The Times* of December 1st, and appending to it items of information and criticism subsequently obtained.

THE SUNSETS AND THE JAVA EARTHQUAKE.

To the Editor of the Times.

SIR,—As the exceptional sunsets (and sunrises) of the present autumn have been referred to in *The Times*, I ask your permission to submit a few facts which seem to me to be related. As, however, the mass of routine rainfall work leaves me little time for other branches of meteorology, I submit the facts rather as an incentive to inquiry by others than as the result of any special investigation by myself. If this letter induces some competent physicist to collect more facts and examine them thoroughly, great good will, I am sure, be done.

For my present purpose terseness is the first essential, and I therefore suppress all references, beyond the general statement that many of the quotations are from *Nature*, some from *The Times*, and the others mostly from letters and newspapers received by myself from various localities.

South East of India and between it and Australia lie the large islands (each of them longer than Great Britain) of Sumatra and Java. They are very long in proportion to their breadth, and their general direction is such that they may be regarded as one long island cut in two by the Straits of Sunda, which are but 15 miles across, or narrower than from Dover to Calais. Nearly in this narrow pass was situate the Isle of Krakatowa, in long. 105° 26′ E., and lat. 6° 8′ S., about five miles long by three broad, and with mountains rising to 2,700 ft. above the sea, covered to the very summit with luxurious tropical vegetation.

On May 20, 1883, to everybody's astonishment, Krakatowa became a volcano, the reverberations being felt at distances of 100 miles. The captain of a passing vessel saw columns of smoke and sheaves of fire rushing up into the atmosphere; miles after he had passed the island, volcanic sand fell on his ship, an "apparently illimitable cloud of drifting pumice was passed through 10 miles away," and at 20 miles another was met with so thick that a bucket was filled with it before it reached the surface of the water. Of course, such an eruption destroyed the vegetation and reduced the island to a desert.

Subsequently a party from Batavia was bold enough to land and partly explore the island. Their report is given at length in *Nature* for November 8, and I therefore quote only one paragraph, because it shows what was going on *before* the great eruption :—

"But in front of the volcano all was wrecked, covered, nay completely buried under pumice dust, which, when the sun shone upon it, became of a yellowish grey colour, while thick masses of condensed vapour, accompanied by incessant fulminations, boiled up from behind the bare and gently sloping dunes. . . . The volumes of vapour were shot out in a strictly vertical direction; the atmospheric pressure in the middle of them must have been something fearful. And from time to time immense funnels became visible, leaning outwards, and into these many of the incessantly changing ravelled wreaths of smoke were sucked. The rest maintained their original form to a height of several thousand feet, then they slowly drifted eastwards [*i.e.* were left behind by the rotating earth], and spreading out into mist, discharged their ashes downwards in black streaks like the dark fringes of rain clouds seen on the horizon."

All these phenomena sink into nothing compared with those of August 26th and 27th, of which we are still without full details owing to the immensity of the catastrophe. The island, with its lofty mountain, seems to have been almost blown away, and the submarine force was such as to produce a wave 30 metres (98 ft.) high, which, sweeping over the low-lands, sucked back with it tens of thousands of the people, while it ruined their houses and lands. (Such a wave would destroy nearly everything in London except the high parts of Pentonville, Notting-hill, and the Regent's Park.) As an indication of its force it is stated that, at Telok Betong, a Government steamer was carried three miles inland.

I wish, however, to deal chiefly with the atmospheric disturbance. We have seen that vast columns of vapour were being projected thousands of feet high *before* the great outburst. What occurred during it we shall probably never know. But we may infer a little from such facts as that ashes fell 250 miles away, and that the whole of North Java became so darkened by the clouds that nothing could be seen except by artificial light for 36 hours.

On September 16th, Mr. J. P. O'Reilly, of Dublin, called attention to the quantity of gases and vapour emitted during eruptions, to their probable relation to the total quantity of matter emitted, and to their exerting some effect upon the atmosphere. But before his letter was published many strange phenomena had occurred.

On September 2nd, just a week after the eruption, it was reported that at Port of Spain, Trinidad, West Indies (!) the sun looked like a blue globe, and after sunset the sky became of so bright a red that it was thought there must be a fire.

Green suns and other unusual chromatic effects in the atmosphere are re-

ported from various parts of Southern India and Ceylon, from about September 8th onwards for several days. Something analogous occurred off East Africa, for Dr. Meldrum, F.R.S., writes :—"The extraordinary sunrises and sunsets observed at Mauritius, Rodrigues, and the Seychelles were probably due to the sun's light passing obliquely through fine volcanic dust floating in the air." In a report respecting September sent to myself, Dr. Meldrum remarks :—"The clouds and sky at sunrise and sunset have been coloured more frequently and to a greater extent than usual. Probably this is partly due to the presence in the air of volcanic dust carried by the upper currents from the Straits of Sunda." And a month later, reporting on the weather at Mauritius in October, he writes :—"Unusually prolonged and intense colourations of the sky before sunrise and after sunset every day, lasting one hour 15 minutes."

My own correspondent at Colombo, Ceylon, reports :—"From September 8th, till about the 15th the rising and setting of the sun was of an unusual green colour."

But we may go to the other side of the world, and there a correspondent (who scarcely ever sends anything but numerical *data*) states that at Barbados "the sun was various coloured on evening of September 15th and morning of 16th." I have already quoted the blue sun at Trinidad.

At Barinas, Venezuela, South America, on September 2nd, from sunrise to noon, and from 3 p.m. to sunset, the sun looked like burnished silver ; between noon and 3 p.m. it was bluish green.

In New Zealand I am told that the sunsets have been gorgeous beyond precedent.

Lastly, in smoky London the sunrises and sunsets of the past month or six weeks have on several occasions been extremely beautiful.

As regards the phenomena in Java itself, there is no doubt that the Government of Netherlands India will give us full information, for it has long supported meteorological research with great liberality. Previous to the disaster the observatory at Batavia was equipped with first-class continuously recording instruments, and if they escaped destruction their records will be of intense interest.

Besides this principal observatory, there were 151 rainfall stations at work on January 1, 1882, and, although doubtless in some cases both observer and rain gauge were carried away by the tidal wave, there can be no doubt that from such a staff, reports of the very highest interest will be obtained.

The losses of the Government are, however, so frightfully great, that I think the investigation of the effects over the whole globe should not devolve upon them ; they will have quite enough to do in investigating the local phenomena.

I am, Sir, your obedient servant,

G. J. SYMONS.

62, *Camden-square, N. W., Nov.* 29.

As one or two writers have not caught exactly the explanation of the phenomena which we intended to convey in the foregoing letter, we think it best to state it in the very plainest words, so as to avoid all misunderstanding, especially as in all probability this will be the last that we shall write upon the subject, several very able men having undertaken to study it.

As the eruption was powerful enough to blow away a mountain 2,700 ft. high, we need not discuss whether there was sufficient projectile force to send some millions of cubic feet of pumice dust through an atmosphere whose total resistance would be 15 lbs. to the square inch—say equal to 12 ft. of ordinary earth. As regards the existence of sufficient pumice dust, besides the unknown quantity which may have been ejected in August, we know that large tracts of Krakatowa were previously "covered, nay completely buried under pumice dust." And even had it been but 1 foot deep, it would give 27,878,400 cubic feet of dust per square mile.

Our idea is that some of the volcanic dust was shot up with such force as to pass through nearly the whole of our atmosphere, and that this fine dust being thus above all winds, and too light in density to be much affected by gravity, was left behind by the earth in its rotation, and would thus soon be seen in the opposite hemisphere to Java. There has not yet been time to investigate the facts, but our impression is that it will be found that for a considerable time the chromatic phenomena were confined between the two tropics, and that it was only subsequently that they were seen in temperate latitudes.

Some writers say that the sunsets, &c., in this country are merely due to ice spiculæ at great elevation, but how comes it that there are extra numbers of such spiculæ at Barbadoes, Madras, Mauritius, South America, South Africa, New Zealand, Ceylon, &c.? and will ice spiculæ produce green and blue suns and moons?* We have heard that the green moon is but the effect of the over-excitement of the retina by the excess of red in the surrounding sky, but we shut off the red sky and yet perceived the green tint. And as regards the ice spiculæ, they must not only be exceptionally widespread, but also unprecedentedly high, or twilight could not be prolonged so exceptionally as it has been, while this prolongation falls in perfectly with the idea of a lofty cloud of dust. As regards the prolongation, besides the facts from Mauritius recorded in the above letter, we may call attention to a letter in the *Standard* of November 30th, in which Mr. E. A. Jackson, writing from Skegness, on the edge of the Lincolnshire fens, states that on November 26th, although sunset occurred at 3.57 p.m., "the western heavens were all aglow until 6.30 p.m." Surely this shows that the matter must be almost, or quite, beyond our atmosphere, to be transmitting to us solar light when the sun has been below the horizon for more than 2½ hours.

Many persons have ascribed the appearances to aurora; they might as reasonably have ascribed them to fog.

One correspondent thinks that the earth is passing through a portion of space where the ether is denser than usual; if so, the phenomena should occur simultaneously all over the globe, which does not seem to have been the case.

* Ought they not also to have given an excess of solar and lunar halos?

We have scores of notices of remarkable sunsets, but few contain precise data as to time, and therefore we are not sure that they need be printed. It may, however, be well to remark that they are mostly from the southern half of Ireland, from East Scotland, and from S, S.E., central and E. England. In other parts it is probable that clouds and rain prevented the phenomena being seen. The following letter gives, we think, the best account of the phenomena of November 26th :

To the Editor of the Meteorological Magazine.

SIR,—Permit me to report a very remarkable phenomenon. On Monday last (26th November), about 4.40 p.m., *i.e.*, half-an-hour after sunset, a most strange unearthly light suddenly shone over the whole landscape here, land and sea, and with a brilliance that rivalled that of the mid-day sun. The source of it was in the western sky, where hung (about 45° up) a hazy undefined looking cloud, the under surface of which, about twenty times the area of the face of the sun, shone for half-an-hour or so with the most brilliant, soft, silver light. At the end of this time, the upper mass of the cloud began slowly to change its colour from black through yellow to deep purple, the whole cloud losing its brilliancy and gradually stretching itself out, throwing out ragged-looking purple arms, which contrasted strikingly with the deep green and blue sky. It seemed, at the same time, to be moving westward, and in about half-an-hour's time from the commencement of the illumination it had disappeared. The sunsets of Tuesday and Wednesday were followed by a very bright and beautifully-coloured western sky, but nothing like that of Monday.—Yours,

WILLIAM MARTIN.

Weston Hall, Bournemouth, Hants, 1st December, 1883.

The *Times* of December 8th, contains a long article upon the subject by Mr. Norman Lockyer, F.R.S., in which he follows the same lines as Mr. Symons, but in much greater detail. He concludes by mentioning, as a difficulty, that somewhat similar appearances were seen in 1831 with no special seismic phenomena to cause them "unless it be the elevation of Graham's Island, in the Mediterranean.'

We do not know where the appearances Mr. Norman Lockyer refers to were seen, but we think that the following paragraphs which we put side by side may very well conclude our notice of the sunsets and the Java earthquake :—

BERMUDA. — "On the morning of August 11th, 1831, I rose early, for the purpose of writing, and soon discovered, the light was so dim, I could not proceed. I removed to another room, and finding my situation not improved, I said, in the presence of one of my family, I apprehend a sudden failure of sight. I was then asked if I had not observed a very peculiar appearance of

BARBADOS, August 11th, 1831. —"Earthquake shocks were felt during a violent hurricane which raged over the West Indies, especially Antigua, St. Vincent, Dominica, Guadeloupe and Barbados. It lasted from 2.30 a.m. to 5 p.m. Barbados suffered at once from the hurricane, the earthquake and a volcanic eruption. 3,000 persons

the sun's rays the day before. I had not; but had perceived the floor of the room to look blue, especially where the sun shone upon it; indeed every object in the room appeared of a sickly blue colour. The next day, the 12th, a mail boat was put under weigh for the first time, with a party on board. The day was so mild and tranquil, we could only reach a few miles; the sails, which were new and pure white, nevertheless appeared to be stained of a bluish colour, and the sea was of a dingy yellow. On the first arrival from the West Indies we heard of the devastation at Barbados; but with us there were no subsequent unusual appearances; on the contrary, we had very fair weather, although I heard [that] this singular blue colour was observed, even to the coast of America —A. W HARVEY, M.D.—*Brit. Ass. Report*, 1840, p. [11].

perished altogether." — "Mallet's Earthquake Catalogue." *Brit. Ass. Report.*, 1854, p. 226.

P.S.—We are becoming a second Krakatowa, but buried under paper instead of pumice. Twice have we recast the above article, and every day brings fresh materials. However, we have little doubt that before another month comes round, some arrangement will be made for the concentration and preservation of a complete record of probably the most tremendous manifestation of seismic energy which has occurred within historic times; and when that has been settled, we shall with pleasure transfer to the proper party all the data we receive.

We must add only a few brief notes.

If these sunsets are due to dust, it is probable that ere very long that dust will fall on the earth; and, therefore, it is desirable to carefully examine the sediment of rain, and especially that from melted snow. Arrangements have been made to secure this being done on Ben Nevis, and on the Puy de Dôme in Auvergne.

The Editor of the *Panama Star* reported a green sun at Panama, Sept. 2nd and 3rd, and attributed it to Krakatowa.

From Port Elizabeth, Cape Colony, we hear that up to Oct. 20th, "the heavens are aflame with it nightly."

The sea beach at Natal on October 31st, and at Kurrachee in N.W. India (date not stated), are each said to have been strewn with pumice and with ashes washed up by the sea.

At Kurrachee, up to about Oct. 21st, the light continued greenish; while in S. Africa it was roseate.

Lastly, we reprint verbatim the report with which we have been favoured by our excellent correspondent, Mr. Todd, C.M.G., Government Observer, describing the appearances observed at Adelaide, South Australia:—

"On every clear evening during October, and the last fortnight

of September, a peculiar phenomenon has been apparent in the western sky. Shortly after sunset, a red glow will make its appearance at an altitude of about 50°, being very faint at first, but as the brightness of the sky near the horizon dies away with the receding sun, the red glow will expand downwards, becoming at the same time more brilliant, until at last the whole western sky will be lit up with a beautiful light, varying in colour from a delicate pink to a most intense scarlet, and the spectacle presents a most brilliant appearance. The upper part will then gradually fade away until the colour is noticeable only 7° or 8° above the horizon, at which time the light is at about its brightest. Afterwards a secondary glow will sometimes make its appearance at an altitude of about 50°, and gradually spread downwards until the sky is again lit up. In the secondary phenomenon, the colours are generally more delicate. The whole thing will fade away about 8 p.m.

"This phenomenon has been noticed all over the south-eastern portion of this continent, from Port Augusta (lat. 32° S.) to Melbourne; and in India, the sun has at times presented a most peculiar appearance, being green at rising, then gradually changing to a blue at noon, and inversely from noon to sunset. Various theories have been started to account for the phenomena."

HEAVY RAIN IN NORTH LONDON, SEPT. 17TH.

To the Editor of the Meteorological Magazine.

SIR,—On receiving last month's Magazine, I was disappointed at not finding any reference to the heavy rainfall of September 17th. which occurred in the neighbourhood of Holloway and Crouch Hill; by the accounts in the public press, the fall of rain was sufficient to flood the roads to a considerable depth, and to stop the traffic for some hours on the Midland Railway at Crouch Hill. Have none of your observers in that district made any note of the rainfall of that day with their monthly returns? The only station of rainfall observation to which I have access, is at Muswell Hill, where ·28 in. fell in about 35 minutes, but this is some three miles from the spot where the storm was reported to be heaviest. *Here* no rain fell, but thunder was heard in the distance.—I am Sir, Your's truly,

J. W. SCOTT.

Springlands, Great Stanmore, Nov. 7, 1883.

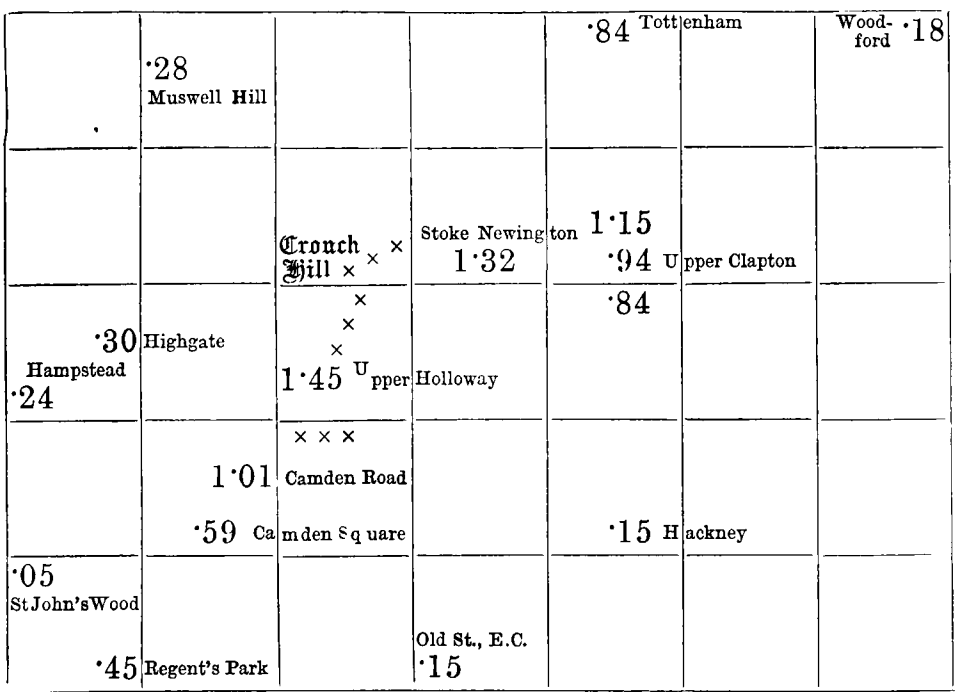
[As London grows, as all its natural watercourses are filled up or converted into sewers, as garden ground with its powers of absorption is changed into acres of slated roofs and paved streets, the influence of a heavy rain becomes more noticeable, and those who live at the bottom of hills resent the speed with which torrential rains run down upon them, and complain that the Metropolitan Board of Works has not made its sewers large enough to carry away the produce of every thunderstorm. But some such complaints are so un-

reasonable as to become ludicrous, *e.g.*, a correspondent says that the rain which we are about to describe converted the Holloway Road into a river 100 ft. wide and 3 or 4 ft. deep in parts,* and he goes on to suggest that a sewer (evidently nearly as large as a railway tunnel) should be made to carry it off. He does not volunteer to bear the cost of such a work.

However, we have to deal only with the fall of rain—and that we do very briefly inasmuch as the following map-diagram gives nearly all the facts. The squares represent square miles and therefore the area represented is 35 square miles, of which the 15 south-western-most miles are almost wholly built over, and the others partially.

SKELETON MAP OF N.E. LONDON,

Showing fall of Rain during Thunderstorm on afternoon of September 17th, 1883.



The sites of flooding were chiefly near the localities marked by × × ×.

The sites of sixteen rain gauge stations are indicated by the decimal point of the amounts recorded at each, or as nearly so as the exigencies of type will permit.

There is a hill called Crouch Hill to the north of Upper Holloway,

* One of our own correspondents saw the water in the Holloway Road nearly up to the floor of the omnibuses—this would prove that in the lower parts of the road water must have been more than 2ft. deep.

where the upper row of × × × are placed, and it seems probable that it was the site of the heaviest rainfall, which very possibly may have amounted to two inches. It was, however, not the quantity of rain which caused the damage, but the rapidity with which it fell. The local newspaper, the *Holloway and Hornsey Press*, says that "an enormous quantity of rain fell within about twenty minutes," and that this was approximately true is shown by the Casella's recording gauge at Camden Square, which gave—

Rainfall at Camden Square, September 17th, 1883.						Possible fall at Crouch Hill.		Actual fall at Camden Square in 1878.
From	3·15 p.m.	to	3·20 p.m.	...	0·06 in.	...	0·20 in.	0·28 in.
,,	3·20 ,,	,,	3·25 ,,	...	0·16 ,,	...	0·55 ,,	0·54 ,,
,,	3·25 ,,	,,	3·30 ,,	...	0·22 ,,	...	0·74 ,,	0·46 ,,
,,	3·30 ,,	,,	3·35 ,,	...	0·07 ,,	...	0·24 ,,	0·28 ,,
,,	3·35 ,,	,,	3·40 ,,	...	0·05 ,,	...	0·17 ,,	
,,	3·40 ,,	,,	4·0 ,,	...	0·03 ,,	...	0·10 ,,	

We are not going to be bound by the wild bit of theory given under the remarkable heading, "Possible Rainfall at Crouch Hill," but will state how it is obtained, and wherein, if at all, it is most likely to be wrong. An examination of the Map will show that the amounts decrease from an imaginary centre north of Upper Holloway, and the rates of decrease are such as to indicate a fall of 2·00 in. at the centre. The fall at Camden Square for each 5 minutes being known, the imaginary 2·00 in. at Crouch Hill, has been divided in the same proportions. The weak point is that it is not known for certain that the fall there did not last longer. However, this calculation gives 1·73 in twenty minutes, and the last column shows that a fall of 1·56 in. in twenty minutes was recorded at Camden Square, in 1878. (*British Rainfall*, 1878, page [79]. And a considerably higher rate was recorded in a storm at Canterbury in 1875, when 2·12 in. fell in twenty minutes.

The immediate disposal of even half-an-inch of rain falling on a square mile of London houses within five minutes, *i.e.*, of about seven million gallons in five minutes is not easily accomplished. —[ED.]

RAINFALL AT RODRIGUES AND SEYCHELLES.

To the Editor of the Meteorological Magazine.

DEAR SIR,—In accordance with the promise which I made during my stay in London, I now send the returns of rainfall from Mahé, the chief island of the Seychelle group, and from Rodrigues, which were sent to me last year by Dr. Meldrum, F.R.S.

The observations were made with gauges 8 inches diameter, standing on the ground.

The seasonal means are as follows :

	Winter. D.J.F. in.	Spring. M.A.M. in.	Summer. J.J.A. in.	Autumn. S.O.N. in.
Seychelles (3½ years)...	40·59	30·18	7·02	23·38
Rodrigues (6½ years)...	15·24	12·47	10·47	4·92

The former is my *régime* I. (as at Moulins).
Rodrigues ,, VII. (as at Bar le Duc).

Yours very truly, V. RAULIN.

Rue du Colisée, Bordeaux.

RAINFALL OF RODRIGUES

(Lat. 19° 40′ S. ; Lon. 63° 30′ E.) Altitude, 20 feet.

By M. YOULTEN before 1880, and M. WALLIS in 1880-81.

	Amount.								Days.	
Years.	1875	1876	1877	1878	1879	1880	1881	Mean	1879	1880	1881
	in.	in.	in.	in.	in.	in.	in.	in.			
January.	...	10·20	7·47	3·86	5·88	2·64	·65	5·12	25	18	12
Feb. ...	...	11·83	8·91	8·13	2·81	5·16	1·58	6·40	20	25	16
March ...	...	·73	11·09	8·96	3·63	2·57	2·00	4·83	23	23	15
April ...	...	4·87	5·00	10·97	2·35	3·81	5·95	5·49	24	22	22
May.....	...	·90	1·23	4·27	2·15	2·72	1·61	2·15	22	25	18
June ..	...	2·19	3·66	1·80	8·85	10·01	3·86	5·06	27	27	23
July.....	...	3·01	1·85	3·98	2·89	2·39	2·95	2·84	26	21	22
August .	1·87	1·68	4·67	1·39	3·02	3·58	1·76	2·57	26	24	22
Sept.....	·65	2·38	1·63	·84	2·43	·83	·94	1·39	23	17	15
October .	·83	1·84	1·35	·28	2·29	·77	·83	1·17	25	14	12
Nov	·92	5·26	4·82	2·32	·30	·70	2·18	2·36	12	7	10
Dec.....	5·42	5·59	2·66	·90	8·01	·27	3·18	3·72	20	12	19
Totals	...	50·48	54·34	47·70	44·61	35·45	27·49	43·10	273	235	206

RAINFALL OF MAHÉ SEYCHELLES,

(Lat. 3° 15′ S. ; Lon. 55° 30′ E.) Altitude, 75 feet.

By M. BARROW in 1876-77, and M. ESTRIDGE in 1880-81.

	Amount.					Days.			
Years.	1876	1877	1880	1881	Mean	1876	1877	1880	1881
	in.	in.	in.	in.	in.				
January	...	...	18·40	13·45	15·92	...	...	20	22
February ..	...	8·15	12·75	15·65	12·18	...	11	18	20
March	...	7·53	12·93	19·02	13·16	...	13	15	22
April	...	10·12	6·40	10·67	9·06	...	13	14	14
May..... ..	10·73	12·75	3·79	4·56	7·96	18	10	12	11
June	4·79	...	1·05	·56	2·13	16	...	13	10
July.....	1·77	3·21	·51	2·49	1·99	12	11	9	16
August	5·26	2·60	·58	3·15	2·90	10	9	12	16
September..	·79	9·62	1·19	12·94	6·14	4	22	12	25
October	6·11	13·52	5·21	9·35	8·55	10	19	9	15
November ..	16·15	7·70	4·37	6·53	8·69	7	14	16	14
December ..	11·37	14·52	6·62	17·46	12·49	11	14	19	26
Totals	56·97+	89·72+	73·80	115·83	101·17	88+	136+	169	211

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1883.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	79·6	24	31·0	4	64·8	44·5	44·1	71	121·6	26·3	1·97	11	5·5
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	80·7	1	63·5	18	77·7	69·2	65·4	77	...	...	6·25	18	5·3
Calcutta	100·2	24	69·6	4	94·1	78·9	77·2	75	163·0	68·2	1·18	7	4·5
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	92·3	31	77·6	2*	90·3	80·0	76·1	74	147·6	71·0	·33	5	2·4
Ceylon, Colombo	90·3	21	72·8	9†	87·5	77·9	74·2	76	155·0	69·0	18·62	17	...
Melbourne	78·5	5	35·8	10	61·2	44·4	45·0	77	123·5	27·5	1·98	13	6·0
Adelaide	76·3	2	40·0	20	62·0	49·5	46·2	70	130·1	31·1	6·46	22	5·5
Wellington	62·0	18‡	39·3	9	57·9	48·4	...	..	119·0	35·0	8·02	17	...
Auckland	66·5	20	43·0	9	62·7	51·1	51·3	82	139·0	37·5	6·50	17	5·5
Falkland Isles	48·8	22	28·3	15	44·2	35·7	37·4	90	98·3	21·0	1·69	21	7·7
Jamaica, Kingston	90·3	14	68·3	20	87·5	72·7	71·6	77	...	64·0	1·15	12	4·6
Barbados	84·0	19	71·0	27§	82·0	73·0	73·3	81	146·0	70·0	2·32	9	6·0
Toronto	72·7	25	31·1	13	58·3	40·2	40·8	69	134·0	23·0	4·30	19	6·8
New Brunswick, S.John	69·0	21	32·0	1	54·4	40·2	42·2	82	...	...	5·52	16	6·4
Manitoba, Winnipeg	72·8	16	20·0	12	57·6	32·7	38·0	68	126·0	...	1·27	7	5·4
British Columbia, Yale	...	...	...	...	...	...	...	...	...	...	...	...	...

* And 4. † And 10. ‡ And 27, 28. § And 31.

REMARKS, MAY, 1883.

Mauritius.—Rainfall 2·62 in., and mean temp. 0°·2 above the average; mean pressure 30·085 in.; mean hourly velocity of wind 10·6 miles, extremes 30·8 miles and 1·7 miles; prevailing direction E.S.E.; T on 9th. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on every day till the 11th; T heard on 26th; L seen on 27th and 28th. G. H. SYMONDS.

Melbourne.—Mean temp. of air and dewpoint below the average; mean pressure and humidity about the average; amount of cloud and rainfall slightly below it; prevailing direction of wind N. and N.E., strong breezes on 5 days; heavy dew on 10 days, hoar frost on 4 days; fog on 3 days; T and L on 16th. R. L. J. ELLERY, F.R.S.

Adelaide.—An exceptionally wet May, in fact the wettest with one exception (1875) since the commencement of the observatory records; the total fall is more than double the average of 26 years. The R extended a little beyond Point Augusta, but N. of this it does not appear to have been very copious; mean pressure and temp. below the average. C. TODD.

Wellington.—Showery, unpleasant weather up to the 7th; heavy R from 11th to 13th, 1·95 in. falling on the latter day; from 14th to 21st fine, with northerly winds; from 22nd to 28th showery, with at times heavy R and very unpleasant weather; winds N.W.; remainder of month fine; strong S.E. gale on the night of 12th; also on 13th; strong N.W. wind on 25th and 26th; very low bar. on 28th, 29·054 in., with heavy R; fog on 22nd, 23rd, and 24th; mean pressure and temp. both very slightly above the average. R. B. GORE.

Auckland.—Pressure and temp. about the average; rainfall greatly in excess. F. F. CHEESEMAN.

BARBADOS.—Mean temp. (76°·6) slightly below the average; direction of wind very uncertain; rainfall 50 per cent., and evaporation 9 per cent., below the average; TSS on 27th and 30th, and L on 29th; one day overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	4·45	XI.	Llanfrechfa Grange	5·86
,,	Margate, Birchington...	2·97	,,	Llandovery	6·65
,,	Littlehampton	4·54	,,	Solva	4·78
,,	St. Leonards	4·48	,,	Castle Malgwyn	6·27
,,	Hailsham	5·34	,,	Rhayader, Nantgwillt..	9·70
,,	I. of W., St. Lawrence.	5·00	,,	Carno, Tybrith	7·62
,,	Alton, Ashdell.....	5·47	,,	Corwen, Rhug	3·91
III.	Winslow, Addington ...	3·13	,,	Port Madoc	6·19
,,	Oxford, Magdalen Col...	3·11	,,	I. of Man, Douglas	5·43
,,	Northampton	2·86	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	2·53	,,	Melrose, Abbey Gate..	2·99
IV.	Southend	2·33	XIII.	N. Esk Res. [Penicuick]	4·15
,,	Harlow, Sheering	2·52	XIV.	Ayr, Cassillis House ..	6·65
,,	Diss	3·14	,,	Glasgow, Queen's Park.	5·82
,,	Swaffham	4·06	XV.	Islay, Gruinart School..	5·03
,,	Hindringham	3·51	XVI.	St.Andrews,NewtonBk	3·01
V.	Salisbury, Alderbury...	4·46	,,	Aberfeldy H.R.S.	...
,,	Warminster	4·52	,,	Dalnaspidal H.R.S. ...	8·72
,,	Calne, Compton Bassett	3·60	XVII.	Keith H.R.S.	1·66
,,	Beaminster Vicarage ...	4·65	XVIII.	Forres H.R.S.	1·52
,,	Ashburton, Holne Vic..	8·35	,,	Strome Ferry H.R.S....	10·25
,,	Torrington, Langtree W.	...	,,	Lochbroom	8·00
,,	Lynmouth, Glenthorne.	8·26	,,	Tain, Springfield.....	2·56
,,	Probus, Lamellyn	6·92	,,	Loch Shiel, Glenaladale	17·16
,,	Taunton, Fullands	3·63	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	4·95	,,	Forsinard H.R.S.	4·44
,,	Ross	3·16	,,	Watten H.R.S.	2·48
,,	Wem, Sansaw Hall.....	3·36	XX.	Fermoy, Glenville	5·72
,,	Cheadle, The Heath Ho.	3·69	,,	Tralee, Castlemorris ...	5·82
,,	Worcester, Diglis Lock	3·77	,,	Tipperary, Henry Street	5·40
,,	Coventry, Coundon	4·70	,,	Newcastle West	6·17
VII.	Melton, Coston	3·73	,,	Kilrush	...
,,	Ketton Hall [Stamford]	3·82	,,	Corofin	6·33
,,	Horncastle, Bucknall ...	3·12	XXI.	Carlow, Browne's Hill..	3·80
,,	Mansfield, St. John's St.	3·08	,,	Navan, Balrath	3·38
VIII.	Macclesfield, The Park.	3·45	,,	Athlone, Twyford	5·38
,,	Walton-on-the-Hill.....	3·11	XXII.	Mullingar, Belvedere...	4·31
,,	Lancaster, South Road.	4·99	,,	Clifden, Kylemore	...
,,	Broughton-in-Furness ..	7·06	,,	Crossmolina, Enniscoe..	7·00
IX.	Wakefield, Stanley Vic.	2·19	,,	Carrick-on-Shannon ...	4·16
,,	Ripon, Mickley	2·94	XXIII.	Dowra	...
,,	Scarborough.....	3·05	,,	Rockcorry.....	4·14
,,	EastLayton[Darlington]	1·42	,,	Warrenpoint	4·02
,,	Middleton, Mickleton ..	2·65	,,	Newtownards	2·90
X.	Haltwhistle, Unthank..	3·59	,,	Belfast, New Barnsley .	4·99
,,	Shap, Copy Hill	8·39	,,	Bushmills	5·00
			,,	Buncrana	4·58

NOVEMBER, 1883.

r.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Date	Min. Deg	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·78	+ ·34	·40	4	16	55·8	28	28·7	13	5	16
II.		Maidstone (Hunton Court)...	3·86	+ ·96	·53	25	18	...	...	...	...	...	...
,,		Strathfield Turgiss	2·54	— ·21	·41	24	22	56·6	28	23·4	13	6	26
III.		Hitchin	2·80	+ ·19	·43	5	19	53·0	6, 25	25·0	11	10	...
,,		Banbury	2·95	+ ·24	·57	5	18	55·0	28*a*	24·0	15*c*	9	...
IV.		Bury St. Edmunds (Culford)	3·24	+ ·41	·71	30	21	55·0	25	22·0	11	...	..
,,		Norwich (Cossey)	3·69	+ ·38	·84	5	21	55·0	1, 25	28·0	12	1	9
V.		Bridport	3·68	...	·57	15	17	...	..	...	...	...	...
,,		Barnstaple.....	7·51	+ 3·36	·71	7	23	58·5	30	28·0	14	...	..
,,		Bodmin	5·58	+ ·26	·68	15	23	56·0	28	33·0	14	0	4
VI.		Cirencester	4·05	+ 1·07	·70	22	17	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	5·25	+ 1·81	1·03	5	20	56·0	28	30·5	13	5	17
,,		Tenbury (Orleton)	4·38	+ 1·52	·66	5	23	58·2	28	19·7	15	14	15
VII.		Leicester	4·00	...	·90	5	22	56·0	28	23·0	12	4	24
,,		Boston	2·82	+ ·45	·95	17	16	55·0	25	29·0	12	...	...
,,		Grimsby (Killingholme).....	2·94	— ·16	·66	30	21	54·5	25*b*	30·0	12	1	...
,,		Hesley Hall [Tickhill].....	2·63	...	·57	30	19	56·0	28	25·0	12	5	...
III.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ..	1·90	— ·86	·32	7	14	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·32	+ 1·57	·86	4	26	53·0	28	27·0	6	7	...
X.		North Shields	1·01	— 2·44	·13	15	22	58·2	28	29·0	12*d*	6	10
,,		Borrowdale (Seathwaite).....	19·84	+ 8·02	2·98	24	23	...	...	...	...	...	..
XI.	WALES.	Cardiff (Ely).....	6·79	+ 2·59	·88	21	22	...	...	...	...	...	...
,,		Haverfordwest	7·44	+ 2·10	1·09	5	22	57·0	2	24·0	13	5	9
,,		Plinlimmon (Cwmsymlog) ...	7·09	...	·92	4	22	...	...	...	...	...	...
,,		Llandudno.....	2·71	— 1·20	·52	30	19	59·0	28	31·8	13	1	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·23	+ 1·32	·90	24	23	54·8	3	24·0	12	8	...
,,		Hawick	2·99	— ·32	·40	4	18	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	6·79	+ 3·24	1·35	24	20	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	9·11	+ 3·75	1·00	19	25	...	...	...	...	...	...
,,		Appin (Airds)	8·84	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	8·31	...	1·05	3	26	...	...	...	...	...	.
XVI.		Loch Leven Sluices	5·50	+ 1·95	1·10	23	14	...	...	...	...	...	...
,,		Arbroath	1·69	— 1·46	·30	24	16	54·0	28	29·0	8, 18	6	...
XVII.		Braemar	3·04	— ·73	·56	10	18	53·2	29	22·0	12	16	27
,,		Aberdeen	1·80	...	·35	24	16	56·0	28	27·0	6	12	...
XVIII		Skye (Sligachan)	25·87	...	4·35	26	24	...	...	...	...	...	...
,,		Culloden	2·48	— ·22	..	...	...	55·0	29	27·0	16	5	22
IX.		Dunrobin	2·70	...	·52	4	13	56·0	1	28·0	18	10	...
,,		Orkney (Sandwick)	4·94	+ ·50	·57	3	27	52·3	28	33·3	7	0	12
XX.	IRELAND.	Cork (Blackrock)	...	...	...	...	...	...	...	...	...	...	...
,,		Dromore Castle	9·23	...	·90	5	29	58·0	1	32·0	6	1	...
,,		Waterford (Brook Lodge) ...	4·01	...	·45	29	25	55·0	3	29·0	8	4	...
,,		Killaloe	7·82	...	·72	21	23	61·0	1	31·0	7	8	...
XXI.		Portarlington	3·39	+ ·99	·54	5	22	57·0	28	27·5	14	6	...
,,		Dublin (FitzWilliam Square)	3·07	+ ·79	·88	5	19	58·7	28	29·4	15	2	6
XII.		Ballinasloe	4·66	+ 1·66	·55	24	27	54·0	28	28·0	14	7	...
XIII.		Waringstown	3·40	+ ·69	·72	15	18	58·0	28	20·0	14	10	19
,,		Londonderry (Creggan Res.).	5·34	...	·76	15	26	...	...	...	...	...	...
..		Omagh (Edenfel)	5·50	+ 2·45	·68	24	26	59·0	29	26·0	13	7	...

+ Shows that the fall was above the average; — that it was below it.
a And 29. *b* And 28. *c* And 16. *d* And 18.

METEOROLOGICAL NOTES ON NOVEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month of November was much finer than the average; although it rained on 22 days, by far the greater portion fell at night, and a much larger breadth of wheat has been sown in consequence, and it is looking well.

BANBURY.—Mean temp. 41°·7; high wind on 7 days, fog on 9 days, H on 3 days, L on 25th.

CULFORD.—A very unsettled month, but mild, and occasionally fine bright days.

BODMIN.—Mean temp. 45°·3.

CIRENCESTER.—A seasonable month without much fog; some pleasant days.

WOOLSTASTON.—Mean temp. 41°·8; a severe gale occurred on the 4th, followed by storms of sleet and H for several days, the H on the evening of the 9th falling with great violence.

ORLETON.—The temp. of the month was variable, but upon the whole more than 0°·5 above the average; it was very cold in the middle of the month, with frequent severe frosts; the sky was generally clouded, and there was much R and only a few bright days; great darkness with heavy R for an hour or two on the 17th and 20th; L and distant T on 20th. The land was very wet, and much wheat was unplanted at the close of the month.

LEICESTER.—The month was very unsettled, the changes coming very quickly; on 13 nights, at 9 p.m., the sky was clear and bright, but in nearly every case R came before morning; on 12th there was a dense fog, lasting all day; on the 18th there were great floods in the country, the result of the heavy R on the 17th (·87 in.)

KILLINGHOLME.—A seasonable month, colder than usual until the last week, when it was milder; the last day very wet.

HESLEY HALL.—Very mild during the last week of the month; a storm of wind and R, with a little S on 19th.

ARNCLIFFE.—S on 9th and 14th; heavy H, T and L on 18th; heavy H showers on 19th.

WALES.

HAVERFORDWEST.—A very stormy, unsettled and wet month; the first two days mild and relaxing, afterwards stormy with heavy rainfall until the 9th, the air then became gradually colder and drier with strong N. and N.W. winds, and from 12th to 14th sharp frost prevailed; the 14th was very dark necessitating the use of lamps, it cleared towards evening, this was followed by a period of very stormy weather and constant R, N.W. winds blowing with great force; on 23rd, the Precelly Mountains were white with S; a great bar depression passed over on 25th, and the weather continued broken for a day or two.

LLANDUDNO.—The mean temp. of the month was slightly above the average, and the range both monthly and diurnal slightly below it; the weather, though occasionally hazy, was on the whole fine and seasonable, there being only one night's frost, and that slight; geraniums, veronicas, roses, and other tender plants in flower at the close of the month; duration of bright sunshine 58 hours.

SCOTLAND.

CARGEN.—A very dull gloomy month, the latter half very wet; duration of sunshine considerably below the average; mean temp. 41°·9, slightly above the average; very bright L on 9th.

HAWICK.—With the exeeption of the 19th, 20th, and 21st, which were

wintry days, the month was genial, and out-door labour was carried on without a hitch.

QUINISH.—A month of almost incessant wind and R, except from 11th to 15th.

ABERDEEN.—The weather during the month was exceptionally fine and mild, with prevailing S.W. winds; rainfall more than an inch below the average. Aurora was seen on 19th and 22nd; L on 4th and 18th.

CULLODEN.—The month generally was favourable for agricultural labour, the weather being particularly fine and mild during the last 10 days; on the 25th a great barometric depression occurred, the mercury falling to 28·320 in. at 3 p.m., but without any storm following.

ORKNEY, SANDWICK.—Rainfall above the average, mean pressure much below it; T and L on 4th and 19th, L on 18th, aurora on 3rd and 22nd. The sea on 19th was remarkably rough, huge waves sweeping far above high water mark, and endangering life and property.

IRELAND.

DROMORE CASTLE.—A month of incessant R, only one day on which less than ·01 in. fell; H on 7th and 19th.

WATERFORD, BROOK LODGE.—Rainfall rather above the average. S on Comeragh Mountains on 10th, H on the 20th and 25th, S.W. gale on 23rd and 24th.

KILLALOE.—The whole month wet and wintry in the extreme; T and L very frequent on the nights of 18th and 19th.

DUBLIN, FITZWILLIAM SQUARE.—A very unsettled, and rather cold month, notwithstanding the occurrence of many bright, sunny days; the mean temp. was only slightly below the average, but this was owing in great measure to a remarkable excess of temp. from the 27th to 30th and to the absence of any extreme cold, rainfall and number of rainy days above the average; L seen on 25th, solar halos on the 5th and 23rd, H and sleet fell on 19th and 20th; fog on 7 days.

BALLINASLOE.—A very wet stormy and dreary month, T and L on 19th, L on 21st.

ROYAL METEOROLOGICAL SOCIETY.

The first meeting of the present Session was held on Wednesday evening, November 21st, at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair. The Earl of Dalhousie, K.T., T. H. Davis, D. E. Embleton, M.R.C.S., J. Hargreaves, and T. L. Lewington were elected Fellows of the Society.

Before proceeding to the ordinary business, the President called attention to the honour recently done to the Society by Her Majesty in permitting it to be entitled the Royal Meteorological Society. He also announced the loss by death of Mr. C. Greaves, C.E., Past President of the Society, and of Sir W. Siemens, F.R.S., to whom the Society was indebted for valuable assistance in the establishment of its experiments on Boston Church Tower.

The following papers were read:—

1. "*Report on Temperatures in two different patterns of Stevenson Screen*," by E. Mawley, F.R.Met.Soc.—The screens employed were an ordinary Stevenson screen obtained from Casella, and a new

Stevenson screen made in accordance with the recommendations of a Committee appointed by the Council of the Society. The new screen is two inches wider and deeper than the old screen. It has also an upper sloping roof, and, at a little distance below, a flat inner roof pierced with holes for ventilation, while the old screen has a single flat roof with only a narrow slit beneath on each side for ventilation. Observations were made during the three months, July to September, and the results are given in the paper. From these it appears that the records from the two screens are nearly identical, but that the new screen is, of the two, slightly cooler and better ventilated, and retains the heat of the sun for a less time than the old screen; also, having a double roof and overlapping boards below, it is better suited for extreme climates.

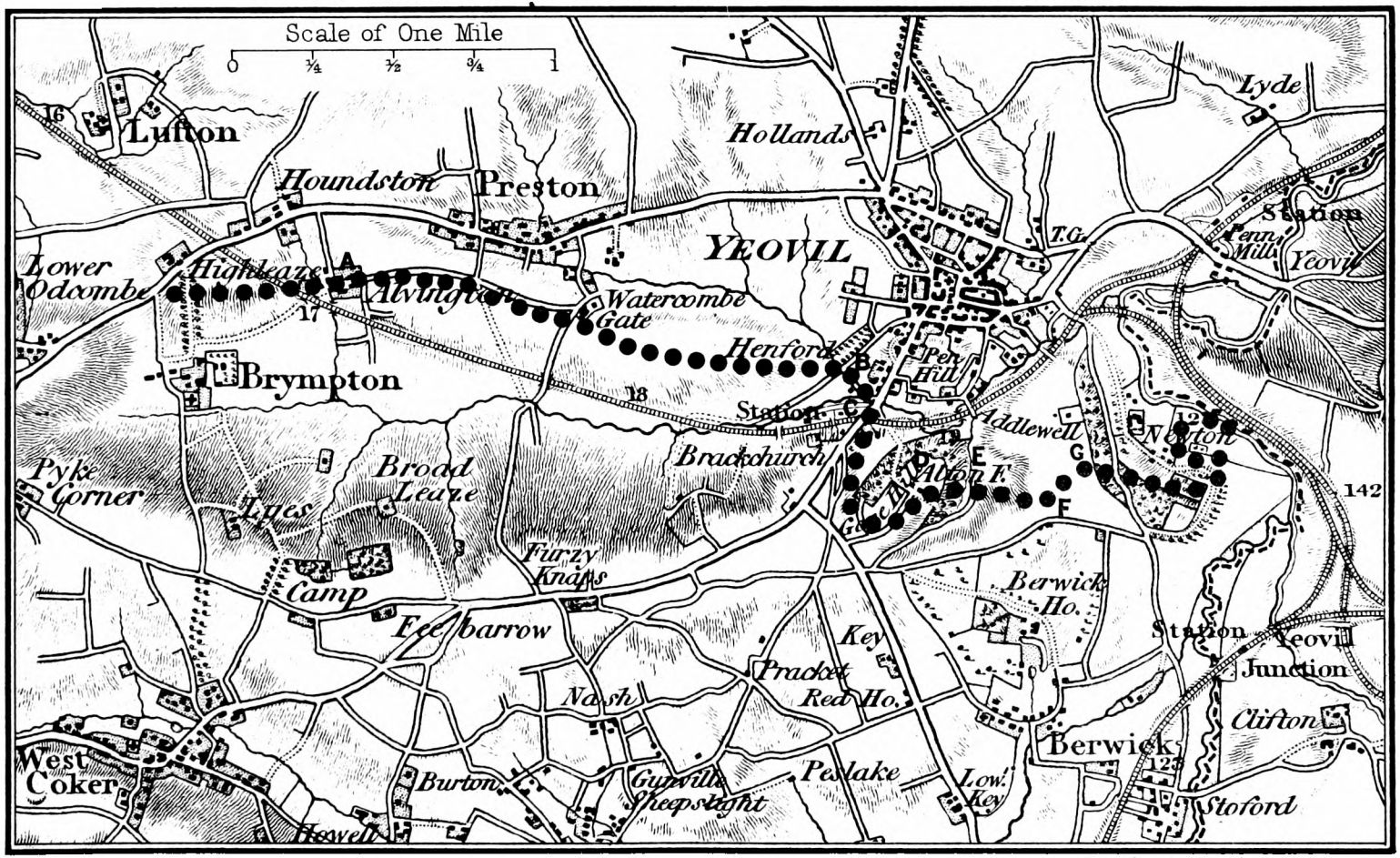
2. *On the Storm which crossed the British Islands between September 1st and 3rd, 1883, and its track over the North Atlantic*, by C. Harding, F.R. Met. Soc., of the Meteorological Office.—This storm caused considerable havoc in the south-west and south of England, owing not only to its exceptional violence, but also to its occurrence before the completion of the harvest. The storm is traceable in the first instance to two centres of disturbance, one being first shown at about 450 miles to the south of Bermuda on the 26th of August, and the other to the east of the Rocky Mountains on the 27th; these two disturbances afterwards merged on the 29th at about 300 miles to the north of Bermuda, and formed one great and destructive gale, which continued to grow in violence as it crossed the Atlantic until it reached the coast of the British Islands. The average speed at which this storm crossed the Atlantic was fully forty miles an hour, which is more than double the usual speed of storms which traverse that ocean.

3. *On the Influence of the Moon on the Height of the Barometer within the Tropics*, by Robert Lawson, Inspector-General of Hospitals.

4. *The Great Ice-storm of July 3rd, 1883, in North Lincolnshire*, by J. Cordeaux.—The direction of the storm was nearly south-east to north-west, and it travelled from Caistor along the higher ridges of the hills to Barton-on-Humber. The storm commenced at about 9.20 p.m. with large drops of rain, which soon became heavy and was followed—amidst the blaze of lightning and the constant roll of thunder—by the rush of hail or rather lumps of ice. An eye-witness remarked that they were not like hailstones but "salt-cellars;" another that they resembled "duck's eggs;" in fact, they were solid lumps of ice of every shape and size, weighing from 2 ozs. to 6 ozs., and some were measured 6 inches in circumference. The injury done to the growing crops cannot be estimated at less than £20,000.*

* For another account see *Met. Mag.* vol. xviii. p. 85.

TRACK OF YEOVIL WHIRLWIND, NOV^{R} 17TH 1883.



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WHIRLWIND AT YEOVIL, NOV. 17, 1883.

HAVING seen some descriptions in the London newspapers of a whirlwind near Yeovil, we wrote to the nearest rainfall observer (Mr. J. Curtis, of Hendford, Yeovil) asking him to favour us with as full an account as possible and also with a map showing the track passed over.

Thanks to his assistance and to that of his son, we believe that the following statement and the accompanying map may be implicitly relied upon.

The general trend of the track is from W. to E. but with a remarkable change to S. at Henford, and subsequently a sinuous path terminating in a circular or at any rate confused movement at Newton. There was no damage in the direct line from Henford to Newton.

In the early part of its course, *viz.*, from Brympton to Henford the heads of all trees were laid down to the E., but at Newton they were all in confusion, lying across each other.

Mr. Curtis remarks that several names are incorrectly spelled upon the map, but as it is an enlargement from the Ordnance sheet, we have thought it best to make the map and article agree, giving in the following list the corrections which should be made. Aldon, not *Alton;* Barwick, not *Berwick;* Braggchurch, not *Brackchurch*, Hendford, not *Henford;* Hewhill, not *Howell;* Placket, not *Pracket;* Pye Corner, not *Pyke Corner.*

As some persons may be sceptical respecting a four-wheel waggon half full of hay being lifted and carried about 30 yards, we refer them to *A lecture on the Storm in Wiltshire*, by G. A. Rowell, where they will find the precise details of a more remarkable case, that waggon being lifted clean over the top of a 12 ft. hedge. The Wiltshire waggon weighed 22 cwt. empty, and as it had hay in it, the weight was probably 23 cwt. or about 1,160 kilogrammes. The Wiltshire waggon was not turned round, but lifted broadside over

the hedge; the Yeovil one was carried rather further, and turned round during the process.

EXTRAORDINARY STORM.

ABOUT noon on Saturday, Nov. 17th, a fearful whirlwind passed over Somerset, causing great damage. It came from the West and passed in an easterly direction. In the village of *Brympton*, three miles from *Yeovil*, trees were uprooted and other damage was done. The splendid avenue of trees leading to *Brympton House* was thinned out, and branches were strewn in every direction. In the adjacent village of *Alvington* several cottages were unroofed, and the tiles and masonry carried some distance. The poor people were obliged to seek shelter elsewhere. Some outbuildings (at A) on a farm belonging to the Hon. Ponsonby Fane were much damaged, and the tiles and woodwork scattered in every direction. Many ricks were also uncovered. Passing along the valley towards *Yeovil*, the wind stripped trees of their branches, snapped others asunder, and levelled many with the ground. The force of the storm was, however, felt over a limited area only, for the course taken by the whirlwind is plainly marked by the fallen trees, the unroofed houses and hayricks, and the branches of trees which almost cover the ground. In front of Mr. H. S. Watts' residence in *Henford*, (B) several trees were snapped asunder and others uprooted. A grand old Chichester elm was laid low in an instant, and several tons of earth could be seen on Sunday still adhering to the roots. Messrs. Bradford's corn stores were stripped of the tiles, and in the timber yard, deals were blown about and broken like matchwood. In the coal yards near, two horses were thrown off their feet, but fortunately were not killed; while a cattle truck was driven on the line at a considerable speed. The trees in front of Mr. Murry's house (C) were broken off and carried across the road, one large limb breaking in Mr. Daley's shop front. A few yards below, a padlock attached to an iron gate was broken off, and the thick iron plate to which it was attached was snapped in two, as if a hard chisel had been used. Strange to say, some solid wooden gates near, on the same property, were not in the least injured. Some leadwork on the roof of the back premises, was, however, doubled up, and a fine tree snapped in two. A man who saw it says, "he shall never forget the sight; trees were bent in every direction; branches and leaves were scattered over the ground; and the noise was deafening. Had the storm lasted a few minutes instead of only a few seconds the damage would have been immense." The whirlwind, passing over *Henford*, caused some damage in *Alton* plantation; and one tree is particularly noticeable, having been stripped of every branch. At *Alton House* (D) a high Hamstone chimney was blown down, and fell through the roof, causing much damage in a bedroom. In the fields near, branches were stripped off the trees, ricks uncovered. and tiles blown off the roofs of outhouses. From *Alton* the wind sped across the valley separating *Nine Springs Hill* (E) from *Constitution Hill* (F) and in a lane on the top of the latter, near *Berwick House*, tipped over several trees. It then took a course towards *Summerhouse Hill*, the site of the Yeovil Corporation Waterworks supply reservoir, just missing the house (G). In the next field, however, it caught a four-wheel waggon, which was partly filled with hay, * and lifted it about 30 yards, turning it round during the process. About

* Another account says, "half full of hay."

half a ton of hay which had been placed on the ground for feeding sheep was blown entirely away. A patch of growing swedes was so pressed by the weight of the wind that they looked as if the leaves had been rolled. As a man was driving a cart along an adjacent lane the wind lifted out the tail-board and a shovel, the former being carried away so that it has not yet been found. Branches of trees fell in front and rear of this man, who was in a state of terror lest some might alight on him ; as it was, one piece just grazed the head of the horse. The wind then descended the hill over *Newton Copse*, where the exact width of the devastating current could be distinguished, and also where it seemed to have raged with the greatest fury.* The resistance to its course had not been hitherto particularly great, though everything in its way suffered. At this point there was more in its way. The wind appeared as if it pressed down the hill, scores of trees having their tops bent and crushed off, others falling prostrate in the direction the storm pursued, whilst many more were standing at all angles, partly uprooted. The road through *Newton Copse*, which leads to *Stopford*, *Yeovil Junction*, and other places, and is cut through soft sandstone, which rises on each side in some places 20 or 30 feet, was strewed with trees, and limbs of others. Several fell across the cutting, and made temporary bridges, whilst in one place the root of a large tree, which had slipped in its fall, actually overhung the road. Here the immense oak, elm, ash, and other trees were broken off like so much match wood, or uprooted with the greatest ease ; and no little time was occupied in clearing the road for traffic.

At the foot of the hill stand the farm buildings belonging to *Newton Farm*. Here the wind burst into the barn, and blew off a quantity of roofing. A horse and cart, which was being driven out of the farm-yard was struck by the gust, and the horse turned round. A fir tree near seemed to spin round and round like a top, but without falling, though some branches were torn off. The wind seems to have gone round and round this tree, twisting the branches and not disturbing the roots. From this point the wind appeared to take another course, and to rise in elevation. After proceeding about 150 yards, it lifted an elm tree out of the ground, and left it standing on its roots, as it did not fall for ten minutes after the whirlwind had passed. Then the tree crashed down on several apple trees in the orchard which it adjoined. Several other fruit trees in different parts appeared to have been lifted out of the ground. This mischief having been done, the wind passed on a considerable distance without doing any damage, the heaviest reported being at *Bradford Abbas*, about two miles off, where some trees are said to have been uprooted. Next it went to *Sherborne*, so it is reported, and did considerable damage.

Eye-witnesses of the phenomenon, as it passed round *Yeovil*, state that it occupied less than two minutes. Prior to the whirlwind, very heavy clouds caused an unusual darkness, and rain fell in torrents, but just before the passage of the wind the rain ceased somewhat, and the sky began to break. All round *Newton*, where there is much timber, the air was thick with leaves, blown from the trees, and lifted from the ground. The murky appearance of the atmosphere, the cracking of the trees, and the noise of the wind, caused no little fear in the minds of the labourers who were working in the fields near the places where the greatest havoc was done. The course of the whirlwind seemed to be sinuous, and easterly in direction.

* Another account gives the average breadth as 150 ft.

ROYAL METEOROLOGICAL SOCIETY.

AT the meeting on December 19th, 1883, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair, the following were elected Fellows —viz., R. Bentley, W. Bonallo, Miss E. Brooke, Rev. A. Conder, T. H. Cowl, J. A. Westwood Oliver, C. M. Powell, W. B. Tripp, and Fung Yee, of the Chinese Embassy.

The papers read were:—"*On the Explanation of Certain Weather Prognostics*," by the Hon. Ralph Abercromby, F.R.Met.Soc. The author explains about forty well-known prognostics belonging to the following groups — 1, Diurnal; 2, sun, moon, and stars; 3, sky; 4, rain, snow, and hail; and 5, wells, springs, and coal mines, by referring them to the isobaric conditions in which they are observed. By this means he is able to indicate the circumstances under which any prognostic fails, as well as those under which it succeeds.

This paper is so interesting that we strongly urge all who are interested in Meteorology (and are not as Fellows of the Royal Meteorological Society entitled to receive the publications of the Society) to obtain a copy when it is published in the Society's Quarterly Journal. The paper will probably occupy twenty or more pages, and their interest may be gathered from the following reprint of the shortest section:—

4. RAIN, SNOW, HAIL.

"Rain with a South-east wind is expected to last for some time."

This prognostic means that if in this country rain sets in with a South-east wind, it may be expected to last longer than rain with a Southerly or Westerly wind. The greater portion of British rain falls with cyclones moving freely towards the East, and in them, as a rule, there is not much South-east wind. Sometimes, however, when the intensity is very great, there is a strong South-east gale in front of such a cyclone, and then the prognostic fails.

There is a not uncommon type of weather, which may be called the Easterly type, in which the presence of a persistent anticyclone over Scandinavia prevents the free passage of cyclones coming in from the Atlantic; they are then arrested in their course, and brood over Great Britain for a day or two without making much eastward progress. Under these circumstances a South-east wind is strongly developed, and the rainy portion of the cyclone never moving on, the rain which belongs to it continues without intermission. The prognostic then holds good, but is, for the reason above-mentioned, subject to frequent failure.

"Short slight showers during dry weather are called a hardening of the drought."

The author has never heard this saying applied practically, but it seems to suggest the slight rain which sometimes occurs in a well-defined anticyclone. This rain is due to the formation of a small short-lived secondary, and is not associated with any tendency of the anticyclone to break up.

If this is the case, continued dry weather would be indicated, and the prognostic fully justified.

"When after a snow shower, the sky clears up quickly, but is again overcome with another shower, this is said to be a 'feeding storm.'"

In such a case the air always feels cold. The forms of the flakes of snow are pretty correct indications of the amount of the fall to be expected. When they are broad and large, and fall slowly, there will not be much, and the probability is that a thaw will soon follow. Should the flakes be spicular, and fall very fast and thick, then a heavy fall or a "lying storm" may be expected, and this last sort of fall is always accompanied by a firm breeze of wind from North-east to South-east.

The wording of this saying is self-explanatory. The whole owes its value to the fact that a long spell of cold weather, which would make snow lie, is usually associated with a North-east or East wind. A spell of these winds often begins with showers, and the dryness associated with them makes the snow flakes fine or spicular, so that they fall fast.

Snow with large broad flakes, falling slowly, is usually associated with the cold West or North-west winds in rear of a cyclone, which rarely last long. Exceptions to this saying frequently occur in the endless phases of the conflict between cyclones coming in from the Atlantic and Scandinavian anticyclones, but still it is a tolerably good prognostic.

"Fresh snow.
Fresh cold."

The idea meant to be conveyed by this saying is, that if during a period of cold weather fresh snow falls, it is the prelude of continued cold weather, not of a thaw.

The explanation depends on the principle that most weather comes in persistent spells, associated with persistent types of pressure distribution. In this country long frosts occur, with both of the so-called Northerly or Easterly types, and this saying holds good when it happens during persistent spells of either of them. On the other hand, an incoming cyclone of the Easterly type, which gives fresh snow, sometimes passes so far to the East, that Westerly winds and warmer weather set in later, and then the prognostic fails. On the whole, however, it is a good one, especially in the North of England and in Scotland.*

"Hail
Brings frost in the tail."

This may be conveniently considered with the allied saying,

"Hail after long continued rain, indicates a clearing up."

The latter holds good when, after the driving rain of a cyclone front, the weather begins to break into squalls with hail, either during or after the passage of the "trough." It is thus symptomatic of the rear of a cyclone, and, therefore, of a clearing up at any season of the year.

Then as to frost following in winter. Hail is more likely than rain to fall in rear of a cyclone when the pressure is rather high to the Westward of Great Britain, in that case the cyclone is usually followed by a large wedge, which in winter would be associated with a white frost of short duration. On one occasion the author observed hail associated with some small secondaries which accompanied the replacement of the Westerly by the Easterly type of weather

* Full details of weather types and their nature will be found in a paper by the author, "On certain types of British Weather," *Quarterly Journal*, Vol. IX., p. 1.

in the month of January. The frost which followed was then of longer duration. On the whole these prognostics are tolerably good, the latter being the best.

The other papers read at the meeting were—"*Preliminary Inquiry into the Causes of the Variations in the Reading of Black-bulb Thermometers in vacuo*," by G. M. Whipple, B.Sc., F.R.Met.Soc. It has long been known that there is a want of accordance between the different instruments used for measuring the intensity of solar radiation; and with a view of ascertaining the cause of the variations in the readings of the black-bulb thermometers *in vacuo*, the author has made a comparison with a number of these thermometers, the results of which are given in the paper. It is shown distinctly that the effect of an increased coating of lamp-black on the bulb is to raise the temperature, and also that the size of the thermometer bulb is a most important factor in the case of this instrument.—"*Report on the Phenological Observations for* 1883," by the Rev. T. A. Preston, M.A., F.R.Met.Soc. Mr. J. S. Dyason, F.R.Met.Soc., exhibited a series of coloured sketches illustrating the recent atmospheric phenomena during November and December.

THE GALE OF DECEMBER 11TH & 12TH.

To the Editor of the Meteorological Magazine.

SIR,—The extraordinary movements of the barometer during the progress of this memorable gale may be worthy of notice. Up to 5 p.m. on the 11th the mercury had been rising, when it began to fall, at first slowly, but afterwards with great rapidity. Between 6.15 p.m. and 10 p.m. there was a fall of 0·570 in. [this gives the unusual rate of 0·152 in. per hour—ED.], and a further fall of 0·201 in. before 2 a.m. on the 12th, when the barometer reached its minimum, the corrected pressure at that hour being 28·729 in. The recovery of pressure was equally sudden and remarkable. Seven hours later (9 a.m. on the 12th), the corrected reading was 29·563 in., showing a rise of 0·834 in. [0·119 in. per hour.—ED.]

It was generally agreed that no storm has been experienced for the last 40 years to equal this in fury.

THOS. G. BENN.

Newton-Reigny, Penrith, 3rd January, 1884.

SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	·63	XI.	Llanfrechfa Grange ...	1·13
,,	Margate, Birchington...	1·62	,,	Llandovery	3·67
,,	Littlehampton	1·22	,,	Solva	2·17
,,	St. Leonards	1·45	,,	Castle Malgwyn	2·59
,,	Hailsham	1·42	,,	Rhayader, Nantgwillt..	6·26
,,	I. of W., St. Lawrence.	1·20	,,	Carno, Tybrith	5·05
,,	Alton, Ashdell.....	1·32	,,	Corwen, Rhug	2·76
III.	Winslow, Addington ...	·83	,,	Port Madoc	4·64
,,	Oxford, Magdalen Col...	·54	,,	I. of Man, Douglas	3·57
,,	Northampton	·70	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	1·25	,,	Melrose, Abbey Gate ..	1·30
IV.	Southend	·91	XIII.	N. Esk Res. [Penicuick]	2·60
,,	Harlow, Sheering ..	·76	XIV.	Ayr, Cassillis House ..	5·38
,,	Diss	2·16	,,	Glasgow, Queen's Park.	4·30
,,	Swaffham	2·17	XV.	Islay, Gruinart School..	4·91
,,	Hindringham	2 38	XVI.	St. Andrews, Newton Bk	1·60
V.	Salisbury, Alderbury...	·88	,,	Aberfeldy H.R.S.	2·72
,,	Warminster	1·00	,,	Dalnaspidal H.R.S. ...	5·81
,,	Calne, Compton Bassett	1·00	XVII.	Keith H.R.S.	2·61
,,	Beaminster Vicarage ...	·77	XVIII.	Forres H.R.S.	2·07
,,	Ashburton, Holne Vic..	2·41	,,	Strome Ferry H.R.S....	10·91
,,	Torrington, Langtree W.	...	,,	Lochbroom	7·87
,,	Lynmouth, Glenthorne.	2·40	,,	Tain, Springfield.....	3·04
,,	Probus, Lamellyn	1·64	,,	Loch Shiel, Glenaladale	18·10
,,	Taunton, Fullands	·95	XIX.	Lairg H.R.S.	3·09
VI.	Bristol, Clifton	1·49	,,	Forsinard H.R.S.	4·93
,,	Ross	·64	,,	Watten H.R.S.	3·67
,,	Wem, Sansaw Hall.....	1·00	XX.	Fermoy, Glenville	1·78
,,	Cheadle, The Heath Ho.	1·72	,,	Tralee, Castlemorris ...	2·91
,,	Worcester, Diglis Lock	·62	,,	Tipperary, Henry Street	2·16
,,	Coventry, Coundon	1·07	,,	Newcastle West	2·07
VII.	Melton, Coston	·85	,,	Kilrush	...
,,	Ketton Hall [Stamford]	1·20	,,	Corofin	1·45
,,	Horncastle, Bucknall ...	1·48	XXI.	Carlow, Browne's Hill..	1·36
,,	Mansfield, St. John's St.	1·49	,,	Navan, Balrath	1·81
VIII.	Macclesfield, The Park.	2·66	,,	Athlone, Twyford	2·20
,,	Walton-on-the-Hill... ..	1·66	XXII.	Mullingar, Belvedere ...	2·10
,,	Lancaster, South Road.	...	,,	Clifden, Kylemore	12·12
,,	Broughton-in-Furness ..	5·98	,,	Crossmolina, Enniscoe..	3·77
IX.	Wakefield, Stanley Vic.	·84	,,	Carrick-on-Shannon ...	2·29
,,	Ripon, Mickley	1·14	XXIII.	Dowra	...
,,	Scarborough.....	2·19	,,	Rockcorry.....	2·40
,,	East Layton [Darlington]	·91	,,	Warrenpoint	2·08
,,	Middleton, Mickleton ..	4·09	,,	Newtownards	1·54
X.	Haltwhistle, Unthank..	3·39	,,	Belfast, New Barnsley .	2·75
,,	Shap, Copy Hill	3·95	,,	Bushmills	3·12
			,,	Buncrana	4·08

DECEMBER, 1883.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32° In shade	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·75	— 1·42	·45	10	14	54·9	13	28·3	7	3	12
II.		Maidstone (Hunton Court)...	1·26	— 1·14	·45	7	13	...	...	...	...	...	...
,,		Strathfield Turgiss	·52	— 1·50	·18	10	14	54·4	13	26·4	6	8	22
III.		Hitchin	·93	— 1·12	·28	10	17	51·0	14	26·0	6,7	12	...
,,		Banbury	·74	— 1·41	·25	15	15	54·0	14	26·0	7	11	...
IV.		Bury St. Edmunds (Culford)	2·40	+ ·25	·37	3, 10	19	54·0	14*d*	26·0	6	11	...
,,		Norwich (Cossey)	2·80	— ·48	·44	5	19	57·0	13	28·0	8	4	5
V.		Bridport	·91	...	·24	15	10	...	..	...	...	...	...
,,		Barnstaple.....	2·91	— ·85	·75	10	16	56·0	1	29·5	8	...	...
,,		Bodmin	1·56	— 3·89	·36	10	22	52·0	14	28·0	7	2	11
VI.		Cirencester	2·54	— ·07	1·12	1	12	..		...	...	...	...
,,		ChurchStretton(Woolstaston)	1·63	— 1·16	·70	10	14	52·0	24	26·0	7	10	11
,,		Tenbury (Orleton)	·67	— 1·84	·28	10	13	55·5	14*e*	25·8	8	4	10
VII.		Leicester	1·02	...	·22	10	22	53·4	13	26·8	7	5	10
,,		Boston	1·06	— 1·01	·16	16	19	54·0	13	31·0	8	3	...
,,		Grimsby (Killingholme).....	1·96	— ·47	·33	16	25	53·0	14	30·5	8	1	...
,,		Hesley Hall [Tickhill].....	1·01	...	·29	16	18	56·0	13	30·0	8	5	..
VIII.		Manchester (Ardwick).....	3·18	+ ·65	·74	10	14	49·0	2*f*	26·0	7	8	...
IX.		Wetherby (Ribston Hall) ...	1·74	— ·47	·36	1, 16	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·51	+ ·23	1·27	10	21	51·0	13	24·0	7	...	...
X.		North Shields	2·38	— ·71	·75	15	14	55·8	13	29·2	8	8	11
,,		Borrowdale (Seathwaite).....	14·92	+ 1·19	3·43	10	22	53·9	13	22·0	7	3	...
XI.	WALES.	Cardiff (Ely).....	2·22	— 1·69	·59	10	15	...	...	...	...	...	...
,,		Haverfordwest	2·92	— 2·21	·45	9, 10	21	53·5	13	26·5	7	2	11
,,		Plinlimmon (Cwmsymlog) ...	5·44	...	1·43	10	18	...	...	...	...	...	...
,,		Llandudno.....	2·12	— ·73	·76	10	14	...	...	...	...	...	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·13	— 1·40	·62	10	18	52·8	13	24·0	7	5	...
,,		Hawick	1·83	— 1·03	·44	21	13	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	4·25	+ ·16	1·04	11	18	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	9·61	+ 3·43	1·25	10	23	...	...	...	...	...	...
,,		Appin (Airds)	7·63	...	...	...		...	...	...	...	...	...
,,		Mull (Quinish).....	9·09	...	·96	12	25	...	...	...	..	...	...
XVI.		Loch Leven Sluices	2·70	— ·96	·60	12	10	...	...	...	...	...	...
,,		Arbroath	1·37	— 1·53	·41	22	9	50·0	24	27·0	8	12	...
XVII.		Braemar	2·23	— 1·20	·42	12*a*	19	47·2	13	20·8	5	18	30
,,		Aberdeen	2·39	...	·42	11	19	54·0	13*e*	25·0	7	13	...
XVIII		Skye (Sligachan)	16·63	...	2·80	29	23	...	...	...	...	...	..
,,		Culloden	2·46	+ ·62	·34	13*b*	11	52·8	24	30·2	6	6	25
XIX.		Dunrobin	4·91	...	·84	2	19	...	...	...	...	...	...
,,		Orkney (Sandwick)..... ..	...	...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	1·48	— 3·28	·36	30	9	...	...	...	...	...	..
,,		Dromore Castle	4·64	...	1·53	13	15	58·0	26	29·0	30	6	...
,,		Waterford (Brook Lodge) ...	1·20	...	·29	27	13	54·0	3, 13	22·0	8	9	..
,,		Killaloe	3·35	...	·76	10	17	55·0	28	20·0	7	10	...
XXI.		Portarlington	1·40	— 1·46	·47	10	17	53·0	28	27·0	6	10	...
,,		Dublin (FitzWilliam Square)	1·26	— 1·32	·53	10	13	55·0	14	30·2	7	5	11
XXII.		Ballinasloe	2·17	— 1·31	·66	10	18	50·0	28	22·0	7	12	...
XXIII.		Waringstown	1·71	— 1·25	·26	10*c*	21	55·0	13	24·0	6,7	11	18
,,		Londonderry (Creggan Res.).	4·06	...	·43	10	25	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·16	— ·24	·47	10	23	57·0	2, 31	29·0	16*g*	11	...

+ Shows that the fall was above the average ; — that it was below it.

a And 23. *b* And 22. *c* And 13. *d* And 15. *e* And 24. *f* And 12, 22. *g* And 26.

METEOROLOGICAL NOTES ON DECEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The open weather continued to the end of the year, closing one of the most remarkable seasons ever recorded here. Young wheat crop and all autumn sown crops stand exceedingly well; a great number of wild flowers abnormally in bloom, in consequence of the mildness of the season.

BANBURY.—Mean temp. 40°; mean pressure 30·153 in.; high wind on 9 days; fog on 7 days; S on 6th and 16th, dropping mist on 13th, 30th, and 31st.

CULFORD.—The month commenced somewhat wintry, and there was but little sunshine throughout; mean temp. 39°·9; stormy, with deep S on 6th, and hurricane on 11th.

BODMIN.—Mean temp. 41°·8; mean pressure the highest recorded during 34 years; rainfall the smallest recorded in December, and never before has the month passed with so little wind.

CIRENCESTER.—An unusually dry, mild month.

WOOLSTASTON.—A sharp spell of cold weather was followed by a severe gale on the 11th and 12th, which did much damage in this neighbourhood; the latter half of the month was unusually warm and mild; mean temp. 39°·1; S on 5th. The remarkable chromatic effects in the sky at sunrise and sunset, were truly magnificent during the greater part of the month, especially at sunset on the 4th, when the moon appeared a bright green colour.

ORLETON.—The rainfall was very slight, being little more than one-fourth of the average, and the fluctuations in temp. were less than usual; there were frosts on many mornings till the 10th, but very few afterwards. The sky was generally cloudy, with a few bright days till the 24th, after which it was very cloudy and foggy; mean temp. of the month was about 2°·5 above the average of 20 years, and the bar. was generally high and steady. The yellow light before sunrise and after sunset, was visible every time that the sky was clear, and frequently appeared through clouds and fog.

LEICESTER.—The month was very mild, with little R, and S on only two days; the end of the month was misty and damp; a very high wind on the night of the 11th did much damage.

BOSTON.—Very heavy gale of wind on the 11th, with T and L. The sunsets throughout the month were very remarkable, and of a most brilliant character.

KILLINGHOLME.—The month was wet, few days without R, but no great fall; fog and very dull skies at the close; destructive storm at night on 11th, and in early morn of 12th. There was an unusual glow before sunrise on two or three mornings towards the end of the month, especially on 24th.

ARDWICK.—The month began with a show of frost, but it soon disappeared; on 11th, a terrific storm of wind occurred during the night, the gusts were intermittent and did a large amount of damage; seven persons were killed in different parts of the city by the fall of chimney stacks, &c. Towards the close of the month the weather became misty and damp, and the temp. high for the season.

SEATHWAITE.—The wind which passed over Seathwaite, on the night of 11th and early morning of 12th, did much damage to both plant and property. Hundreds of trees were blown down in Borrowdale—including the famous yews, one was torn up by the roots and the other three were left almost bare, little more than the trunks being left—slates, and in some cases whole roofs, were carried away; S on hills, on 15th and 22nd.

WALES.

HAVERFORDWEST.—This month was characterized by uniform mildness, nearly constant damp, gloom, and fog; but on the few evenings that were clear, the sunsets were gorgeous, every variety of colour blending indescribably. A

sudden and very sharp frost set in on the night of 6th, disappearing as suddenly on 9th. The wind blew with great force on the 10th, 11th, 12th and 13th, to 15th; the weather was then fine and cold to the 18th, from which time, to the end of the month, constant fog, excessive gloom and drizzling R prevailed, the sun never once visible.

SCOTLAND.

CARGEN.—An exccedingly dull, gloomy month, only 31 hours of sunshine, the average being 61 hours; mean temp. 2° above the average; the bar. on several occasions was remarkably high; mean pressure 30·003 in. A very severe storm occurred on the night of the 11th—12th; it reached its greatest force between 1 a.m. and 2 a.m., and was accompanied by T and L; immense damage was done to trees and plantations in the district, thousands of acres of plantation being completely levelled, and thousands of the finest trees uprooted.

HAWICK.—The month was most remarkably mild, and so free from frost, that the East Lothian stock was in beautiful bloom. A hurricane occurred on the 11th, which overthrew trees and some houses here.

KILMORY.—An exceptionally severe gale blew on the night of December 11th and following morning; judging by its effect on trees in this neighbourhood, it would appear that its greatest force here far exceeded that of the Tay Bridge storm, or indeed of anything in the present generation; the worst was early on the morning of the 12th, when the wind shifted more to N. of W., the effect in the blowing down of hardwood trees which do not generally suffer much, was most remarkable, roots as thick as a heavy man's thigh snapped off; also spruce, and silver fir stems, two or three feet diameter broken off short some distance above ground.

ABERDEEN.—The weather was open and mild for the season; there was no quantity of S, and the rainfall was an inch below the average; a heavy W. gale occurred in the early morning of the 12th; aurora seen on 1st and 18th. The most notable phenomena during the month were the gorgeous sunrises and sunsets.

CULLODEN.—The closing month of the year was remarkably mild, frost only on 6 days; the severe gale experienced elsewhere was somewhat less felt here.

IRELAND.

DROMORE CASTLE.—A fine open month, fairly dry, without any great cold.

WATERFORD, BROOK LODGE.—Rainfall less than half the average; S on Comeragh Mountains on 16th; heavy N.W. gale on 11th.

KILLALOE.—Excepting a few nights' sharp frost in the first week of the month, the weather was generally mild; mean temp. 41°·6 above the average, rainfall about the average

WARINGSTOWN.—The month was dry and mild; a very heavy gale occurred on the night of the 11th, doing great damage to timber, &c.

ABSENCE OF SUNSHINE.

The remarkable absence of sun that has been experienced of late has been the reverse of favourable to early forcing operations. In the meteorological report issued last Monday from the Greenwich Observatory, it is stated that the sun re-appeared on Sunday the 6th Jan. for the first time since the 23rd Dec. The maximum temperature in the metropolis on the same day was 51°.—*Journal of Horticulture.*

THE SUNSETS AND THE JAVA EARTHQUAKE.

We do not, at present, offer any further remarks upon this subject; for although the literature upon it is becoming very extensive, we have not yet seen any fact recorded that is not consistent with the view we adopted at the very first—that the whole appearances are due to the dust thrown up in Sunda Straits—but if we do see any other reasonable explanation, it shall be duly quoted in these pages.

We have, at present, room only for the two following letters :—

PINK SEMICIRCLE OPPOSITE THE SUN.

To the Editor of the Meteorological Magazine.

SIR,—There is one striking phenomenon of the remarkable sunrises and sunsets which I have been very much surprised not to see mentioned, and yet it is a phenomenon I never saw before they began. I allude to a great pink semi-circle opposite the sun, which is at its best about twenty minutes before sunrise and after sunset. It does not last many minutes at each time, which may be the reason it has not attracted so much notice as the wide pink ring round the sun or moon, which is much less conspicuous, and doubtless arises from the same cause, for it, also, I never saw before. It has been more or less visible each morning that the sky has been clear enough, ever since the strange sunsets began. I have not seen it so often in the evening. I first noticed it on the morning of November 27th. It consists of the upper half of a very broad bright ring, whose outer radius is perhaps 25°, and inner about half that; it is more or less pink, sometimes a deep pink, but sometimes the inner half is white. Its edges are indefinite. The space within is darker, and always more or less blue. The centre seems just opposite the sun.

I would ask your readers whether this phenomenon is of frequent occurrence, for though I never saw it before, I am aware that this is no actual proof that it does not often occur; for it is much easier to see a phenomenon again, than to discover it. But if, as I believe, it is a phenomenon connected with the sunrises and sunsets, it is to my mind more striking and characteristic than any other of their features, which makes it the more strange that it has been so little observed. I suppose, also, that if any one has sufficient optical knowledge, it should throw much light on the cause of the fine sunrises, &c.—Yours truly,

THOS. WM. BACKHOUSE.

Sunderland, 11th January, 1884.

P.S.—I found yesterday afternoon, and again this morning and afternoon, that the semicircle is visible, though very faintly, when the sun is above the horizon; but there appears to be an interval, about sunrise and sunset, when it disappears entirely. This morning it was distinctly visible from 8.48 to 8.58, and had a slight pink tinge, the interior being blue as usual. It then gradually faded, but at 9.45 was still faintly visible, and nearly white as compared with the neighbouring sky.—T. W. B., *Jan. 12th.*

THE SUNSETS IN SHETLAND.

To the Editor of the Meteorological Magazine.

SIR,—I wrote you on Monday, and sent the rainfall for 1883, but I made no remarks on the season, because this was my first year of observation. It strikes me that I might have told you that the strange appearance of the atmosphere which has lately been noticed and remarked on in the south, has been equally observable here. Red sunsets used to be very common with us, and generally indicated good weather. Red in the morning, again, was a sure precursor of a heavy gale of wind before night. This season, *i.e.*, during the past part of the winter, red mornings have been very prevalent, but they have not been followed by the usual rough weather. The red, however, that has been observed this season is of quite a different tinge from what used to be. It lacks the bright scarlet tinge, and partakes largely of an orange colour. But, in fact, I have noticed the clouds in the evening assuming colours which I never saw them have before, viz., a deep sea green, such as you may have noticed on fresh water slime in stagnant or rotten pools in summer.

Yesterday about 4 p.m. the sky from the W. to the S.E. was all a very deep sea green, and the moon actually appeared green, or rather like a linen sheet, deeply tinged with laundry blue. Whatever the cause may be, the appearance is quite abnormal. I have seen nothing like it during forty years. I may notice that it has no connection with the aurora borealis. This season has been marked rather for the absence of aurora borealis.—Yours truly,

JAMES IRVINE.

Public School, Olnafirth, Voe Delting, Lerwick, January 2nd, 1884.

SEVERE FROST IN AMERICA.

PHILADELPHIA, JAN. 6TH, 1884.

An intensely cold wave is moving eastwards across the Continent. The mercury is already reported to be 24° below zero in Nebraska and Iowa, 48° below at Jamestown, Dakota, 39° at Bismarck, and 45° in Manitoba. As the wave is moving eastwards, the glass has now recorded 27° below zero at Cincinnati, 14° below at Cleveland, and 20° below at Chicago, where the air is filled with frost, and the intense cold has broken many large plate glass windows.

The cold was preceded in the north-west by heavy snows, which have blocked the railways and impeded the traffic. Many of the cattle and hogs in the snow-bound trains were frozen to death.

The cold wave had reached the Atlantic seaboard last night, the mercury falling to below zero universally in the northern States, and also as far south as Tennessee. At Chattanooga it was 2° below.

In several places serious fires have occurred, which were with difficulty got under, for the extreme cold hindered the firemen's operations by causing the engines to work badly. There were several fires in Chicago last night, and others in Cincinnati. The firemen were covered with ice while they were working. Several fires are reported to have broken out at Cleveland, where the Park Theatre, together with some adjoining buildings, has been burnt down, the loss amounting to $300,000.

END OF VOL. XVIII.